Synthesis and Characterization of Hybrid Adsorbents Based on Organoclays and Polyxilosanes for Hexavalent Chromium Removal

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Abstract:

The increasing demand for innovative materials in environmental remediation has driven the development of hybrid systems with enhanced performance and functionality. In this study, a hybrid organoclay was synthesized by modifying a nanoclay surface with HexaDecylTrimethylAmmonium, a cationic surfactant, and incorporating a Per Arylated Polysiloxane as a structural support to enhance its stability and adsorption properties. Thermal analysis using TGA confirmed the successful incorporation of the surfactant, evidenced by a characteristic weight loss between 200-400 °C, corresponding to the decomposition of organic components. Adsorption experiments demonstrated that the synthesized organoclay achieved a maximum Chromium VI removal capacity of 2 mg/g under controlled experimental conditions. The kinetic evaluation revealed that the adsorption process is predominantly governed by external mass transport mechanisms, highlighting the importance of optimizing particle size and contact time for improved performance. These findings emphasize the potential of hybrid organoclays not only as effective materials for water treatment applications but also as versatile platforms for addressing heavy metal contamination in diverse environmental scenarios. Future studies will focus on improving the material's regeneration capacity and exploring its performance under real-world conditions, ensuring sustainable and cost-effective solutions for environmental challenges.

Keywords:

Remediation, Organoclay, Cationic surfactant, Adsorption, Water treatment.