

## Synthesis, characterization and optimization of poly(p-phenylenediamine)-based organoclay composite for Cr(VI) remediation

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### ABSTRACT:

The contamination of the water supply with high levels of heavy metals from various human and industrial activities continues to present a major environmental problem. Heavy metals such as hexavalent chromium (Cr(VI)) are of particular concern since they pose serious health and environmental risks. Many polymeric materials with remarkable anion adsorbing properties have been developed and reported in the literature. However, there is still need to reduce the cost and/or improve the performance of these materials for environmental remediation. We report here the synthesis, characterization and application of a poly(para-phenylenediamine) (poly-pPD) organoclay-based composite for removal of Cr(VI) complexes from wastewater. Adsorption capacity of the composite was evaluated at different sample pH, contact time, adsorbent dose and initial concentration. The poly-pPD-based organoclay adsorbent with < 55% of the polymer showed similar superior performance to pure polymer over a wide pH range compared to pristine organoclay. Adsorption was better described by the pseudo second-order kinetic model and Langmuir isotherm model, suggesting that chemisorption was the main mechanism of the adsorption process. The Langmuir maximum adsorption capacity for Cr(VI) was 217.4 mg/g and 185.2 mg/g whereas for total Cr it was 193.3 mg/g and 148.8 mg/g for poly-pPD and poly-pPD-organoclay, respectively. Using XPS, it was proven that the adsorbent also reduces Cr(VI) to Cr (III). The prepared poly-pPD-organoclay showed reuse over seven times but

still retaining 80% of the recovery for Cr(VI). The composite also performed excellently in batch application to real industrial wastewater containing high levels of Cr(VI) ions and competing anions such as nitrates and sulfates.