

Adsorptive Performance of Surface Modified Montmorillonite in Vanadium Removal from Real Mine Water

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Abstract : This paper describes the preparation of surface modified montmorillonite using hexadecyltrimethylammonium bromide (HDTMA-Br) for the removal of vanadium from mine water. The adsorbent before and after adsorption was characterised by Fourier transform infra-red (FT-IR), X-ray diffraction (XRD) and scanning electron microscopy (SEM), while the amount of vanadium adsorbed was determined by ICP-OES. The batch adsorption method was employed using vanadium concentrations in solution ranging from 50 to 320 mg/L and vanadium tailings seepage water from a South African mine. Also, solution pH, temperature and sorbent mass were varied. Results show that the adsorption capacity was affected by solution pH, temperature, sorbent mass and the initial concentration. Electrical conductivity of the mine water before and after adsorption was measured to estimate the total dissolved solids in the mine water. Equilibrium isotherm results revealed that vanadium sorption follows the Freundlich isotherm, indicating that the surface of the sorbent was heterogeneous. The pseudo-second order kinetic model gave the best fit to the kinetic experimental data compared to the first order and Elovich models. The results of this study may be used to predict the uptake efficiency of South Africa montmorillonite in view of its application for the removal of vanadium from mine water. However, the choice of this adsorbent for the uptake of vanadium or other contaminants will depend on the composition of the effluent to be treated.

Keywords : adsorption, vanadium, modified montmorillonite, equilibrium, kinetics, mine water

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