

Adsorption kinetics and isotherms of Ni (II) and Zn (II) heavy metals onto a natural adsorbent: expanded perlite

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ABSTRACT

The diversity of wastewaters varies depending on the development of industry and the application of different production processes in each area. Heavy metals that cause toxic effects in the wastewater are left untreated by many sectors. These heavy metals are then transported by natural resources (rainwater, etc.), which have a negative effect on the natural environment and disturb the balance of life. Even in very low concentrations in water, heavy metals can cause toxic effects that can lead to illnesses and even deaths in living organisms. The technologies and methods used to remove heavy metals are inadequate. An investigation into the adsorption with expanded perlite on nickel and zinc was therefore conducted to ascertain which has the most important poisoning effect. Specifically, the adsorption of Ni (II) and Zn (II) ions with expanded perlite was investigated through measures of pH, contact time, initial metal concentration, and the adsorption effect of the adsorbent dose. The results showed that the Ni (II) ion conforms with the pseudo-second-order kinetic model, in which the Zn (II) ion equilibrates within 10 min and within 5 min. The initial metal concentration was chosen to be 5 mg/L for both ions, and the expanded perlite dosage was 0.4 g for Ni (II) and 0.5 g for Zn (II). In adsorption isotherm studies based on metal concentrations, the Ni (II) ion conforms to the Freundlich isotherm model with $R^2 = 0.91$ and the Zn (II) ion conforms to the Langmuir isotherm model with $R^2 = 0.97$.

Keywords: Heavy metals adsorption; Water treatment; Natural adsorbent; Expanded perlite

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