Removal of nickel from wastewater using an agricultural adsorbent

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Abstract

Chemical wastewater streams may contain toxic compounds which are non-biodegradable, and therefore require advanced treatment techniques such as adsorption. However, application of adsorption processes is often limited by the cost of adsorbents. In this study, the adsorption capacity of a low-cost adsorbent (pine sawdust) was investigated by treating wastewater containing nickel (II) and other heavy metal ions. Results were analysed using response surface methodology and a factorial design was employed to determine the interactive effects of the various factors on the adsorption capacity. Furthermore, Langmuir and Freundlich adsorption isotherms were fitted to experimental data to characterise the adsorption of the nickel ions by the pine sawdust. As a result, the highest adsorption capacity was attained at the combined effect of low adsorbent dose, high pH and high initial concentration. On the other hand, the Freundlich isotherm fitted the experimental data better than the Langmuir isotherm. Results of this study indicate that the use of pine sawdust could be a promising solution to the elimination of nickel ions from multi-component aqueous solutions.

Keywords: sawdust, adsorption, nickel ions, wastewater, isotherm