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Removal of Copper (II) Ions from the Effluent by Carbon Nanotubes Modified with Tetrahydrofuran

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ABSTRACT

In this study, a carbon nanotube modified with tetrahydrofuran was first synthesized. After preparing the adsorbent, discontinuous adsorption experiments of copper metal were performed on the adsorbent. Atomic absorption spectrometry was used to measure the concentration of copper metal. In this paper also, the effect of contact time, adsorbent amount, pH, initial metal concentration and temperature were investigated. The experiments were performed at concentrations of 2 ppm to 35 ppm and at temperatures of 303 to 343 Kelvin. The results showed that the highest removal efficiency was obtained at pH about 5. Equilibrium contact time for 6 ppm concentration was obtained in 30 minutes and the optimal adsorbent is 0.2 g. After optimizing these variables, the maximum absorption value was 96.33%. Kinetic studies of copper removal by synthesized adsorbent were performed. The results obtained for discontinuous experiments follow the quasi-quadratic kinetic model with (R^2 = 0.9931). Also, equilibrium studies of adsorption show that the adsorption process is better consistent with the Tamkin isotherm (R^2 = 0.9683). In thermodynamic analysis, it is observed that the adsorption process is an endothermic process due to the positive enthalpy changes 3287.32 ($\frac{j}{mol.o_K}$) , and the positive sign of Gibbs free energy at temperature 303 ^oK with value (1715.53 j) shows, the process is non-spontaneous. It is also a sign of positive and equal entropy changes (5.187 J * -K), which indicates an increase in entropy during the adsorption process in the system. Therefore, the absorption process is associated with an increase in irregularities.

1. Introduction

At the beginning of the growth of small communities, urban, industrial, industrial and service wastes and effluents were discharged into rivers and it was even thought that these wastes feed on fish and aquatic organisms and cause their growth and development. It was on this basis that the Mississippi River became a conduit full of municipal and industrial waste, and as a result, in 1928, the discharge of waste into the rivers of some American states was banned, and since 1965, special laws for the disposal of various pollutants and industrial and urban effluents were laid [1-4].
In developing countries, the lack of proper enforcement and regulation of laws and the decentralized growth of industry have caused water resources, especially rivers, to become more polluted every day. Surface runoff and groundwater are of great environmental importance due to their widespread human and industrial uses [5]. Any contamination of surface runoff upstream has many adverse effects downstream, so that all consumers, including humans, animals and industry, are exposed to environmental hazards [6]. Also, providing safe and hygienic water and protecting resources from pollution is one of the current concerns of the government and decision-making centers [7]. Therefore, the need to prevent the destruction of water resources and surface runoff, by identifying, measuring pollutants and setting and enforcing laws becomes more important. In this regard and in order to achieve this important, the project of measuring heavy metals lead, zinc and cadmium in sensitive rivers of the country, investigating the number

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