ASSESSMENT ON THE VALUATION OF THE ECONOMICS AND ENVIRONMENTAL EFFICIENCY OF HEAVY METAL IONS ADSORTION FROM THE WATER ENVIRONMENT OF POLYMER-BASED MATERIALS

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ABSTRACT

This study evaluates the Ni(II) adsorption capacity of adsorbent composite from polymer (PAN) and copper oxide (CuO), referred to as PAC material. The adsorption process of Ni(II) on PAC material is consistent with Langmuir isotherm adsorption model; Experimental results showed that the maximum adsorption capacity of Ni(II) on PAC achieved very good results compared to other materials, the time to reach adsorption equilibrium was 100 minutes, the optimal pH was 4.
The regeneration of PAC achieves over 85% efficiency. PAC composites show outstanding advantages for heavy metal processing in aqueous environments.

Keywords

Adsorption;
Polymer;
CuO;
Langmuir;
Wastewater.

INTRODUCTION

- Today, the strong development of the economy and thepopulation explosion has polluted the living environment, among them is the problem of heavy metal pollution in water. The most popular methods of removing heavy metal ionssuch as chemical precipitation, ion exchange, adsorption, membrane filtration,coagulation or ozonation,...
- Some adsorbent materials such as activated carbon, silicagel, ion exchange resin, zeolite,... not only achieve effective treatmenthigh, but also has advantages in terms of economic and technical factors. Metal oxides such as Al2O3, CuO, Fe3O4, are materials capable of removing some heavy metals from the aqueous environment.
- However, because these metal oxides often exist in the form of nanometer-sized fine particles, when used in aqueous environments,will be very difficult to recover. Therefore, most of the studies on the world is geared towards combining or pairing these oxides withanother polymer to address these limitations.

METHODS AND MATERIALS

In this study, we prepared CuO with polyacrylonitrile (PAN) to disperse and localize the metal oxide crystal lattice in the PAN network created by chemical bonding, limiting the leaching of CuO when using adsorbent materials. aggregates in the aquatic environment. Characterization of PAC composites and their adsorption propertiesfor Zn(II) in the aquatic environment was investigated.In this paper, we use PAC composites to adsorb Ni2+ nickel ions and evaluate the process of teaching environmental education for high school students at the University of Education, Hanoi National University. Interior.

RESULTS

Figure 1: Among the conventional techniques such as physical, chemical or biological (as shown in Figure 1). These methods were investigated, and each of these methods had its advantages and drawbacks in the wastewater treatment. For example, in the chemical precipitation, which had relatively facile, low-cost and non- metal selective. However, it need a large production of sludge, hazardous byproducts, and slow settling.
Figure 2: In the Figure 2 showed the EDS image indicating the elemental composition in our material PAC. In order to confirm the existed elements such as carbon, oxygen and copper in the PAC. It might be assumed that the successful synthesis of nanomaterial PAC.
Figure 3: The adsorption capacity of PAC completely varies from 1 to 8 pH. In this range of pH values, the adsorption capacity of PAC can achieve high values over a wide pH range. The results in Figure 3 indicate that pH = 4 is the most ideal for removing Ni(II) metal.
Figure 4: Within the first 30 min, the Ni(II) adsorption efficiency increased to 70%. When the time after 100 min, the adsorption efficiency of Ni(II) did not change much. Thus, we can choose the adsorption equilibrium time to be 100 minutes. The results shown in Figure 4 show that the adsorption capacity of PAC increases with time. The adsorption time mainly occurred in the first 30 min. After 100 min, the absorption reached equilibrium and reached 95 %.

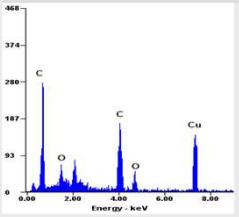
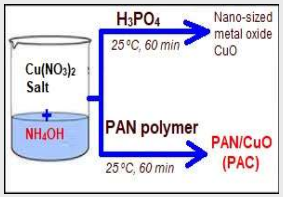


Figure 2. EDS mapping



Scheme 1. PAC synthesis

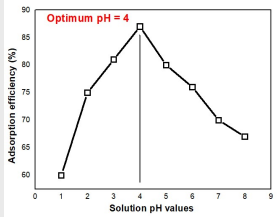


Figure 3. Effect of pH

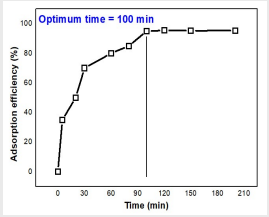


Figure 4. Effect of time

Technologies to remove heavy metal

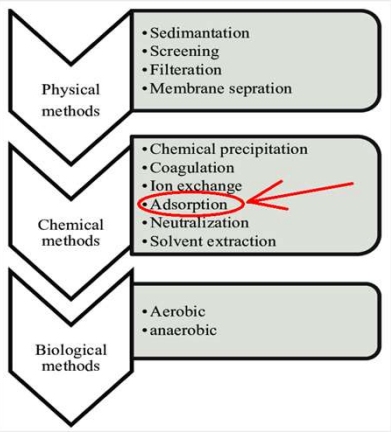


Figure 1. Conventional methods

CONCLUSIONS

In this project, we investigated the factors affecting the adsorption of Ni(II) of PAC materials and concluded some issues as follows:
- The time to reach adsorption equilibrium is 100 min and the optimal pH is 4. The adsorption process of Ni(II) on PAC material is suitable for Langmuir isotherm adsorption model;
- The process of preparing PAC nanocomposite materials has been introduced in an easy, simple and low-cost way.
In summary, PAC materials have advantages for removing heavy metals Ni(II) in addition to aqueous media.

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