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VOLUME IV

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CHAPTER 7

CARBON NANOTUBES TO REMOVE NICKEL

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ABSTRACT

Adsorption experiments were carried out to evaluate the performance of carbon nanotubes (CNTs) as the adsorbent for the removal of nickel ions (Ni^{2+}) from aqueous solution. The effects of solution pH, CNT dosage, contact time and agitation speed were studied at 25°C with constant initial nickel concentration of 5 mg/L. The adsorption study has demonstrated that the highest removal of Ni^{2+} is 56.52%. The statistical optimization of the experimental conditions was carried out using central composite design (CCD) to develop the regression model to determine the optimum conditions. The data were further analyzed to evaluate the interaction between the parameters involved. The adsorption capacity of CNTs and powdered activated carbon (PACs) was also compared. From this study, it was determined that the optimum conditions for maximum removal of nickel are pH 8, CNTs dosage of 300 mg/L, contact time of 50 minutes and agitation speed of 100 rpm. This study also showed that impregnated CNTs have adsorption capacity of 16.1 mg/g.

Keywords: adsorption, nanotubes, adsorption, agitation, optimization

INTRODUCTION

Nanotechnology literally means any technology performed on a nano scale that has applications in the real world. Basically, it involves the management of material with nano scale dimensions, which range from 1 to 100 nanometers. Their nano size dimensions are one of the important reasons for their unique properties which normally could not be found from other materials. The science and technology research in nanotechnology promises breakthrough in various areas such as material and manufacturing, electronics, medicine and biotechnology. Hence, it can be said that this new technology may provide the building blocks for further technological progress and improved standards of living.

One of the most advance materials developed by nanotechnology is Carbon Nanotubes (CNTs). CNTs which were discovered in 1991 by Sujio Iijima have attracted attention from physicists, chemists, engineers and other allied sciences. Fundamentally, their name was derived from their size, since the diameter of a CNT is in nanometers, but they can be up to several micrometers in length. CNTs resemble a coiled-up graphene sheet and their remarkable mechanical, electrical, thermal and chemical properties have offered significant potential in various fields. For example, the large surface area, cylindrical structures and