CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME IV

Editors:

Ma'an Alkhatib
Abdullah Al Mamun
Faridah Yusof

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(VOLUME IV)

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Abdullah Al Mamun
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Department of Biotechnology Engineering
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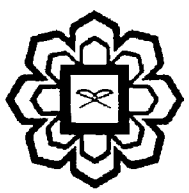
International Islamic University Malaysia



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ADSORPTION ISOTHERM OF CARBON NANOTUBES IN REMOVING HEAVY METALS

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ABSTRACT

This study was carried out to evaluate the application of carbon nanotubes for the adsorption experiment for Copper and Chromium ion removal. All of these aqueous heavy metals were prepared at five different initial concentrations which are at 5 mg/L, 10 mg/L, 15 mg/L 20 mg/L and 30 mg/L. The experiments were conducted at pH 7, 150 rpm agitation speed, and temperature at 27^0C. The experiments were conducted for individual heavy metal and in matrix. Langmuir and Freundlich models were used to study the kinetics of the adsorption behavior and to determine the adsorption capacity of the carbon nanotubes. It was found that Freundlich model was better than Langmuir model. Adsorption study has demonstrated that the highest adsorption capacity was exhibited for copper in matrix (51 mg/g) and single (121.75 mg/g) metal solution. With respect to the percentage removal of the heavy metals CNTs adsorbed copper faster than chromium. The removal efficiencies at 5 mg/L concentrations of each metal in matrix solution were 77% for copper and 67% chromium.

Keywords: adsorption, chromium, copper, Freundlich, Langmuir, kinetics

INTRODUCTION

Heavy metals are usually present in industrial, municipal, and urban runoff, which can be harmful to humans and aquatic life. Increased urbanization and industrialization are to blame for an increased level of trace metals, especially heavy metals, in our waterways. There are over 50 elements that can be classified as heavy metals, 17 of which are considered to be both very toxic and relatively accessible. Toxicity levels depend on the type of metal, its biological role, and the type of organisms that are exposed to it. The heavy metals linked most often to human poisoning are lead, mercury, arsenic and cadmium. Other heavy metals, including copper, zinc, and chromium, are actually required by the body in small amounts, but can also be toxic in larger doses. As a result more stringent requirement for the removal of heavy metals from aqueous environment, in recent years have necessitated the development of innovative and cost- effective treatment alternatives.

Therefore, in regards to the potential applications in industry, medicine, and research; nanotubes are by far the most important fullerene discovered to date. Nanotubes are all carbon, crystalline macromolecules that resemble strands of rope or string. They are built around one of the strongest bonding forces in nature: the covalent bond between carbon atoms (Physics World, 2000). The adsorption of heavy metals by nanotubes has been studied which