

Optimization of Copper Ion Removal from Wastewater by Using Coal Fly Ash

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Abstract— Most of the adsorbent used for removal of heavy metal is activated carbon. It is an expensive material, so that the use of alternative and cheaper adsorbent, which formed as coal fly ash. The coal fly ash is a waste material that generate from industrial processes, but has potential to adsorb copper metal ion. By using this material was removing copper metal ion by using batch experiments in that is Single Metal Solution (SMS). The adsorption data obtained for the experimental work form Freundlich adsorption isotherms. It was found that particle size of coal fly ash 90 μ and 300 μ mesh removed 84.49%, 81.86%, copper metal ion within contact time concentration is 60 min.

Keywords— Coal fly ash, Metal ion solution, Freundlich Isotherm, Adsorption.

I. INTRODUCTION

The treatment of this type of wastewater involves adsorption techniques such as solvent extraction, adsorption, filtration, precipitation, ion exchange, biological treatment and destruction technique such as ozone process and oxidation. In this regard, coal fly ash is a very attractive alternative because coal fly ash is cheap, widely available. Coal fly ash obtained from the combustion of powdered coal as a waste product. Fly ash quality depends on coal ash type, coal ash particle are fineness, percentage of coal ash in coal, combustion technique, air fuel ratio and boiler type. Much of this coal fly ash however, is capable to have recovered and used. Example of these applications are additives for immobilization of industrial and water treatment wastes, extraction of valuable metals, such as Al, Si, Fe, Pb, Ni, Zn, Cd, Cu. Among all of adsorption, methods are the most effective and economical because of their relative low cost.

The objective of this study is to use coal fly ash as a low- cost waste material in removing and recovery of heavy metals from industrial wastewater. Precipitation leads to complete removal of heavy metals by formation of hydroxide ions, but absorption i.e. adsorption surface precipitation could be more effective to immobile metallic ion fly ash. The main goal of this study was to use coal fly ash as an adsorbent of cations within experimental condition.

II. MATERIALS AND METHODS

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A. Adsorbent

Preparation of activated carbon by using Coal Fly Ash (CFA): Coal fly ash was collecting from burning of coal at the time of metallurgical process in the foundry industry. This CFA had converted into activated carbon by using fractional distillation methods and burning at high temperature. This CFA had washed with tap water to remove any dust and foreign particles attached to CFA and thoroughly rinsed with distilled water. The washed CFA had dried at 50°C, and then thoroughly washed with clear distilled water until the color of washing water is clear. The powdered CFA had dried in an oven at 50°C to a constant weight. The CFA was again ground to powder and was sieved with three different sized meshes. Three different grades particle sizes were obtained. First particle size was 90 μ and second particle size was 300 μ . All the particle sizes were selected for further study.

B. Adsorbate

Stock solutions of metal ions : Stock solution was prepared in de- ionized water from the respective sets of five metals (Pb²⁺, Cu²⁺, Zn²⁺, Ni²⁺ Cd²⁺) under investigation. The resulting stock solutions are stored in the airtight plastic bottle.

C. Analysis

The concentration of metals ions in the solutions before and after equilibrium had determined by Perkin-Elmer 3100 Atomic Absorption Spectrophotometer. For the toxic metal the concentrations copper metal ion in the solutions before and after equilibrium