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Coconut Shell Biochar for Removal of Cu(II) from Aqueous Solution

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Abstract

The ability of coconut shell biochar (CSB) and acid-base modified coconut shell biochar (MCSB) for the removal of copper (Cu(II)) from aqueous solution is examined. The basic characteristics of CSB as well as MCSB such as proximate analysis, pH value, surface area, surface morphology and surface functional groups are investigated. The individual effect of initial concentration and contact time on the removal efficiency of Cu(II) by CSB and MCSB was determined using one variable at a time (OVAT) approach. In addition, the response surface methodology (RSM) approach is applied to determine the combined effects of variables (pH, contact time and particle size) on the removal efficiency of Cu(II) ion. The RSM results for the MCSB showed that Cu(II) maximum removal efficiency is 99.50% at pH 7, contact time of 60 min, and particle size of 0.60 mm, respectively. It can be concluded that MCSB has greater potential than CSB to be utilized as an adsorbent for Cu(II) removal in water bodies.

Keywords: Coconut shell, Biochar, Adsorption, Cu(II), Response surface methodology

Introduction

Rapid population growth has triggered the development of industrial activities such as paint, coating, alloy preparation, plating and tanning [1]. The lack of attention given to the disposal of industrial wastes has resulted in the deterioration of the environment especially to natural bodies of water. The accumulations of dangerous pollutants like heavy metals in natural water bodies have raised concerns all around the world. Heavy metal pollution is one of the alarming environmental issues.

Heavy metals pollution in water bodies is a serious problem that may threaten human health, aquatic life and its environment [2]. The content of heavy metals that are beyond a certain limit can lead to hazardous effects on living organisms such as nephropathy, blood and brain disorders, abdominal pains and miscarriage [2]. However, due to their scientific importance, heavy metals are still being applied in numerous industries and productions. Industries such as a battery, paint, electroplating and steel have been generated along with them, heavy metals like cadmium, copper, chromium, lead and nickel [2].

The use of Cu(II) in numerous industrial activities such as alloy industries, Cu polishing, plating, electronics plating and paint manufacturing are common [3]. Copper