Prediction of Copper Ion Biosorption with *Sargassum* and *Padina* .sps Brown Algae by Multiple-Regression Analysis

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ABSTRACT

In comparison to the conventional physicochemical treatment methods for mining contaminated effluents, biosorption gained importance due to its inherent advantages such as low operating costs, high efficiency, and possible biomass regeneration. Brown algae due to their high number of binding sites are most promising absorbent in biosorption applications. Dried biomass of the marine macro algae *Sargassum* .sp and *Padina* .sp (brown) are studied in terms of their Cu (II) biosorption performance. The purpose of this research is application of multiple-regression analysis to predict the removal capacity of the biosorbents and determine the most influencing parameters in batch biosorption such as pH, initial solution concentration, retention time, shaking rate and sorbent dosage. Comparing the simulated and real data showed a good correlation for the predictably of proposed models. The developed multiple-regression model can provide accurate information for treatment process of copper loaded mine effluents by the considered biosorption technique.

Keywords: Biosorption, Brown Algae, Copper Ion, Multiple-Regression Analysis, Acid Mine Drainage (AMD)

INTRODUCTION

The production of mining effluents containing high amounts of sulfate, heavy metals, and low pH is a worldwide problem. The effluents are known as acid mine drainage (AMD) and the primary sources coal mining, where AMD is formed when sulphide ores undergo chemical and biological oxidation processes (Coetser et al. 2005). Serious problem facing the mining industry presently is the enormous mass of mill tailings (about 18 billion cubic meters per year) and is expected to double in the next 20-30 years. Water infiltrating through these becomes acidic and this acidic nature of the solution allows the metals to be transported in their most soluble form. It is further estimated that an annual output of 14 million tones of heavy metals are being mined with an annual growth rate of 3.4% (Sheoran et al. et al. 2006).

Between a numbers of the pollutants, copper is one of the important heavy metals which widely using in electroplating industries so is placed the main purpose of this paper. The presence of copper causes serious health problems; it is known to deposit in the brain, liver, skin, and pancreas (Davis et al. 2000).

A number of technologies such as chemical precipitation, evaporation, electroplating, adsorption and ion exchange processes have been used to remove copper (II) from wastewater (Golestanifar et al. 2007). However, these technologies are most suitable in situations where the concentrations of the heavy metal ions are relatively high, they are either ineffective or expensive when heavy metals are present in the wastewater at low concentrations, or when very low concentrations of heavy metals in the treated water are required (Kaewsarn, 2002; Kuyucak and Volesky, 1988).

Biosorption of heavy metals from aqueous solutions is a relatively new technology for the treatment of wastewater (Schiewer and Volesky, 2000). It has the advantage of achieving high purity of the treated wastewater involving inexpensive sorbents. Absorbent materials (biosorbents), derived from a suitable biomass, can be used for the effective removal and recovery of heavy metallic ions from wastewater streams. Studies on various types of non-living biomasses such as algae, fungi, bacteria, yeast, nut hulls, and wood sawdust, among some other lingo-cellulosic wastes, have shown that such biomaterials may be used for removal of toxic metal ions from wastewater (Davis et al., 2003; Herrero et al., 2006; Gupta et al., 2006; Grimm et al., 2007).

Comparison of different types of biomasses from reported data is difficult since biomass performance strongly depends on the metal ion and environmental conditions used in sorption experiments (Cochrane et al., 2006). Grimm et al. (2007) compared three biomass, birch wood *Betula* sp., marine brown alga *Fucus vesiculosus*, and terrestrial moss *Pleurozium Schreberi*, as raw materials for preparation of biosorbents for removal of copper ions from diluted water solutions. They showed higher ability of the marine algae than other ones as the function of maximum sorption capacity which in decreasing order is as follows: marine alga (23.4 mg/g), moss