UNIVERSITI TEKNOLOGI MARA

ADSORPTION OF COPPER (II) IONS FROM AQEUOUS SOLUTION ON NATURAL AND MODIFIED AGRICULTURAL WASTE

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In the name of Allah, The Most Gracious, The Most Merciful

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ABSTRACT

The use of agricultural waste as an adsorbent for industrial effluent remediation is economically feasible due to its low operating costs. Thus, this research has been undertaken to identify the potential of raw and modified corncob and pineapple waste to produce suitable adsorbent for scavenging divalent cations of copper (II) ions in aqueous solution. In this regard, powdered natural and hydrochloric acid-treated agricultural waste namely raw corncob (RCC), chemically modified corncob (CMCC), natural pineapple waste (NPW) and acid-treated pineapple waste (ATPW) were prepared to analyze and compare the adsorption performance by batch sorption system. The influence of basic physicochemical parameters such as pH of the solution (pH 2-5), contact time (30-120 min), adsorbent dosage (0.25-1.0 g), and initial copper ion concentration (10-50 ppm) were determined in this work. The optimum condition removal of Cu2+ ion by corncob and pineapple waste were at pH 5.02 and pH 4, respectively, 120 min, 0.25 gram of adsorbent and 40.8 mg/L of initial concentration of copper ions. Equilibrium data were further analyzed to evaluate the kinetics and isotherm behavior of the adsorbate - adsorbent system. Kinetic data analysis revealed that pseudo-second order kinetic model was best obeyed whilst equilibrium data showed a better fit of Langmuir than Freundlich isotherm models for both wastes. The maximum adsorption capacity (qmax) from Langmuir isotherm model was found to be 2.52, 2.36 1.97 and 1.72 mg/g for ATPW, CMCC, NPW and RCC. It can be concluded that the overall performance of the prepared acid treated adsorbents indicated better adsorption capacity than natural adsorbents with the depicted presence of statistical significant difference between both adsorbents.

Keywords: *Adsorption; Agricultural waste; Corncob; Pineapple; Hydrochloric acid; Copper; Isotherm; Kinetics.*

CHAPTER ONE

INTRODUCTION

1.1 Background

Water bodies such as rivers and ocean are the basic requirement for humans and wildlife and the availability of clean water is crucial for maintaining a healthy life and environment. However, while global water demand increases annually, various forms of pollution have exposed potential water sources (Sharma & Sanghi, 2012). Due to numerous numbers of water pollution occurrence, it increases the demand for water treatment and also needs a large amount of cost to clean up the pollution. Water pollution can be harmful to humans due to potential exposure to hazardous substances via inhalation, absorption, ingestion, and injection (Tchounwou *et al.*, 2012). According to Joseph et al (2019), the impact of increased pollution is particularly problematic in developing the country as these populations do not have enough resources and expertise to treat contaminated water or access effectively for clean drinking water systems that can supply to the community and also can cause death to human due to water-related diseases.

The increasing demand on industry activities due to rapid growth of human population contribute to environmental pollution such as soil, water, noise, air, radioactive and thermal pollution that affect human health and various form of life on the earth. The major pollution produces by the industry area is water pollution such as a large amount of heavy metal effluent discharge especially from the electroplating industry, chemical processing plants, agricultural and municipal activities (Chen *et al.* 2016). Heavy metals, such as lead, iron, nickel, copper, and cadmium, have serious