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Daftar isi

Coating of active carbon from oil palm shells with magnetite particles and adsorption tests on Cu(II) ions in solution

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Abstract. This study aims to determine the ability of activated carbon from oil palm shell coated with magnetite (Fe_3O_4) (ACC-M) to adsorb Cu(II) ions in solution. Production of ACC-M adsorbent begins with the activation of oil palm shell carbon physically-by heating at a temperature of 700°C. Magnetite coating on activated carbon was done by adding Fe^{3+}/ Fe^{2+} solution to the activated carbon suspension followed by adding NaOH solution to pH of 10. Characterization of ACC-M included surface morphology analysis with Scanning Electron Microscopy-Energy Dispersive-X Ray (SEM-EDX), surface area and pore diameter determination with the Brunauer-Emmett-Teller Surface Area Method (S_{BET}). The adsorption test of the solution of Cu(II) ions by ACC-M adsorbent was carried out by batch method including a series of experiments, namely the effect of adsorbent dosage, determination of adsorption kinetics, and isotherm models. The result shows that in the use of 0.4 grams of ACC-M adsorbent at the interaction time of 60 minutes and pH of 5, the adsorbent are able to adsorb Cu(II) ions with the adsorption capacity of 99.60%. Thus, ACC-M adsorbent is a highly effective adsorbent to absorb Cu(II) ions in solution.

1. Introduction

Development industrial progress especially in the micro-electronics industry, metal processing, battery production, gilding, and fertilizers produces wastes containing heavy metals such as Cd, Cu, Pb, Hg, Ni, Zn, and As [1,2,3]. One of the most toxic heavy metals are copper (Cu) if the levels that enter the human body cross the threshold. The US Environmental Protection Agency also sets the maximum limit of contamination of Cu(II) ions in drinking water is 1.3 mg L^{-1} [4]. High toxicity makes the metal in water sources must to be reduced [5,6]. Heavy metal contamination in the human body in some cases causes health problems such as diarrhea, kidney damage, cancer, harm autoimmunity, even decease [7].

There are various methods have been developed to reduce the types of heavy metal waste from water sources such as coagulation, extraction, flocculation, ion exchange and adsorption [8,9,10]. Adsorption is the most applied technique because this technique is simple, relatively cheap, and environmentally friendly [11]. The success of the adsorption process is largely depended on the selection of suitable adsorbents to the adsorbate to be absorbed. Several types of adsorbents have been applied in the absorption of heavy metals such as those from cassava peel waste [12], algae biomass [5,13], and activated carbon [14].

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