Adsorption of Cu(II) Ion on Zeolite A Synthesized from Coal Bottom Ash in Fixed Bed Column System

Nurul Widiastuti, Fahimah Martak, Hamzah Fansuri and Mia Ratnasari
Department of Chemistry
Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia, 60111

*Corresponding Author’s E-mail: nurul_widiastuti@chem.its.ac.id

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Extended Abstract

Coal usage as a source of energy in Indonesia is increasing nowadays. In 2003, the usage of coal in the electric power plant was about 14.1% of total energy and in 2025, it will be over 34.6% (Yanti, 2009). The increase in coal usage causes the increase of coal ash waste, which was up to 500-1000 ton per day (Said, 2010). The discharged coal waste may cause self burning or self exploding and have negative effect to human health. Therefore, under Indonesian regulation (PP85/1999), coal ash is classified as hazardous and dangerous waste (Said, 2010). In order to reduce the piling up, coal ash must be utilised. One of potential utilization of coal ash is to convert the ash to become zeolite minerals.

On the other hand, the wastewater disposed by industries is causing hazards to the environment and drinking water due to presence of heavy metal contaminants like Cu(II) ion (Alinnor I J, 2007). Therefore, the present work deals with the Cu (II) ion removal using zeolite-A synthesized from bottom ash by the fixed bed column method. The zeolite-A was synthesized from bottom ash by fusion method followed by hydrothermal method (Yanti, 2009 and Fansuri et al., 2010) and formed into granules by addition of kaolin as a binder. The XRD pattern and Scanning Electron Microscopic of the synthesized zeolite-A and zeolite-A granule are shown in Figure 1.
The synthesized zeolite-A granule was then used in adsorption study in fixed bed column. In this research, flow rates were varied at 1.5 mL/min; 3 mL/min and 4 mL/min and the amount of adsorbent dosages were varied at 0.5 g; 1 g and 1.5 g in order to determine the optimal condition. Results can be seen in Figure 2. The adsorption capacity of Cu(II) increases with the decreases of flow rate and the increase of the amount of adsorbent dosages.

Kinetic models for column adsorption including Bohart-Adam model, Thomas model as well as Yoon and Nelson model were examined to fit the experimental data. Thomas model is the best kinetic model with the satisfactory fit of the data. The highest adsorption capacity of 181.32 mg/g was achieved at flow rate of 1.5 mL/min, adsorbent dosages of 1.5 g, and initial concentration of 50 mg/L at pH 6.

![Figure 2. Breakthrough curve of ion Cu(II) adsorption using zeolite-A granule at various flow rate (a) at initial conditions: pH = 6; C_o = 50 mg/L; 1 gram of adsorbent, and at various the amount of zeolite-A granule (b) at initial condition: pH = 6; C_o = 50 mg/L; flow rate = 1.5 mL/min)](image)

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**References**


