CHAPTER I
INTRODUCTION

I.1. Background

Beside rice stem and its root, rice husk is one type of the largest waste that generated from agricultural. The processing of rice husk waste into another product can help to decrease the waste and increase the usability of the waste (Syahrain, *et al.*, 2016). One type of rice husk waste used as raw material for synthesis hydrogel (Oliveira, *et al.*, 2016). This hydrogel can be used for water purification from hazardous heavy metal such as copper (Cu) (Yang, 2016). Rice husk waste is a potentially raw material because of its cellulose content for hydrogel based cellulose (Handayani, *et al.*, 2015). Shukla research in 2013 said that rice husk waste have cellulose content about 35%-42% and hemicellulose 18%-25% (Shukla, 2013).

Research study shown that hydrogel can be applied to biodegradable materials such as for drug delivery, sensors, contact lenses, and adsorption (Chang et al, 2010). In this research hydrogel was applied to adsorb Cu in aqueous solution. Yang research in 2016 states that hydrogel can be used to adsorb Cu^{2+} almost 100% from water in 48 hours. The other material proved to be effective for the adsorption is clay minerals like zeolite. Recent studies also show that the adsorption capacity of hydrogel can be increased by combining them with organic materials (Saputro, 2016). Therefore in this study, the zeolite combined with hydrogel into hydrogel-composite removing Cu.

Hydrogel composite was studied in preparation and characterization include the best condition for synthesis hydrogel-composite (such as ratio between cellulose with urea/sodium hydroxide/ECH, temperature and reaction time). Fourier Transform Infrared Spectra (FTIR), X-Ray

Diffraction (XRD), Scanning Electron Microscopy (SEM), Energy Diffraction-X (EDX), analysed are performed for hydrogel-composite characterization. Adsorption capacity of the hydrogel-composite against Cu was studied by using kinetic and isotherm adsorption model. Kinetic adsorption was performed at intervals of 30 minutes until reach the equilibrium state. Kinetic adsorption model Pseudo 1st and 2nd order were used to express the adsorption parameter. Meanwhile, the isotherm adsorption was studied with Langmuir and Freundlich equation. The effect of pH on adsorption capacity was studied.

I.2. Problem Formulation

1. How the ratio of cellulose and NaOH/ECH does affected the properties of hydrogel-composite?
2. What is the effect of hydrogel composite if applied in the adsorption of Cu ?
3. How much time to reach the equilibrium state in the adsorption of Cu with hydrogel composite?
4. How does the pH affect the %removal of Cu to hydrogel composite?

I.3. Objective

1. To determine the best ratio between cellulose and urea/sodium hydroxide/ECH in producing hydrogel with swell-able property.
2. To study effect of hydrogel composite in adsorption of Cu by using kinetic and isotherm adsorption.
3. To determine time to reach the equilibrium state in copper (Cu) adsorption by Hydrogel-composite.
4. To study the effect of pH in Copper (Cu) adsorption by Hydrogel-composite.

I.4. Problem Limitations

1. Addition of zeolite is limited until certain amount that gives best appearance of hydrogel.
2. Waste of heavy metal Cu used is synthetic waste from solution of $CuSO_4$.