# UNIVERSITI TEKNOLOGI MARA

# ADSORPTION OF COPPER AND LEAD USING COFFEE GROUND

EMMA HASLINDA BINTI SABRI

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# ABSTRACT

The contaminated waters have become a serious threat to the environment. The main sources of contaminated water are from industries which releases hazardous heavy metal (Cu, Pb, Zn, Cd, Cr and etc.) In this study, removal of copper and lead has been investigated by using coffee ground as adsorbent. Coffee ground was used as adsorbent to avoid environmental pollution and profitable uses waste. The adsorption of copper and lead was determined by Atomic Adsorption Spectrophotometer (AAS). The effects of relevant parameters including adsorbent dose, initial concentration and contact time adsorption were examined. This experiment was conducted at room temperature and no pH adjustment was made prior to the analysis. Batch adsorption revealed that the amount of copper and lead ion adsorbed increases as the adsorbent dose increase. The decreasing in the percentage removal for coffee ground from 91% to 66 % with initial concentration of 200 mg/L to 250 mg/L respectively. The further increases on the initial concentration is expected to decrease the percentage removal. The equilibrium was achieved at 120 min for copper and lead ions. Based on linear regression, the best fit for copper and lead ions was pseudo second order. The data indicated that the adsorption of copper and lead ions by coffee grounds was best described by Langmuir isotherm model. Result showed both physisorption and chemisorption mechanisms controlled the adsorption rate and capacity respectively.

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# INTRODUCTION

## 1.1 Research Background

Water are important since it is very useful in our daily life. Water are used for drinking, bathing and other purpose. Water pollution by industrial has become an earnest threat to the environment. Heavy metals such as lead, nickel, cadmium, mercury, copper and chromium metals are very harmful to human health and environment. It is because it contains high toxicity of heavy metals. Constant vulnerable to the heavy metals may cause side effect to our body(Edathil et al., 2018).

The contaminated waters become major problems over the research in recent years because of the toxicological quandaries on ecological systems. The most prevalent methods for removal of lead wastewater are filtration, chemical precipitation, electrochemical treatment, ion exchange and adsorption (Anastopoulos et al., 2017). However, a few methods are very extravagant which are not opportune for some countries due to the economic problem. Adsorption is widely used due to the efficacy and low cost. However, some adsorbent is quite expensive such as activated carbon, zeolites activated alumina and silica gel. Therefore, the alternative adsorbent is used due to low cost, effectiveness and environmentally friendly. Agricultural wastes and food industry wastes such as red mud, sawdust, rice husk and coffee ground has been put on trial as precursor of adsorbent.

Coffee are the most common beverage consumed in many parts of the world. Substantial amount of coffee ground have been discharged worldwide in the order of 6,000,000 tons/year from instant coffee manufacturing(Mussatto et al., 2011). Coffee ground is the final residue that can be obtained from extraction process of coffee beans. Part of the development in adsorption technology is to use coffee grounds as alternative adsorbent to remove pollutant from wastewater.

However, this study is focus on the removal of lead ion from aqueous solution using coffee ground. Batch study was conducted. The Langmuir and Freundlich isotherm models were tested for the adsorption of lead ion.