HEAVY METAL REMOVAL BY AGRICULTURAL WASTE : ADSORPTION OF Cd(II) BY OIL PALM FIBER AND COCONUT COIR

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Contents

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5. Report

5.1 Proposed Executive Summary

Heavy metals have been excessively released into the environment due to rapid industrialization. Contamination of wastewater with heavy metals ions have created a major global concern due to their toxicity. Heavy metal ions are considered as persistent environmental contaminants since it cannot be degraded and destroyed thus causing various disease and disorder. Adsorption by activated carbon is one of the method found to be effective in removing heavy metals from aqueous solution. However the application of activated carbon for wastewater treatment is not feasible due to its high price and cost associated with the regeneration. The use of agricultural waste as adsorbent have been widely investigated to replace the costly activated carbon. Most of the adsorption studies have focused on chemically or physically treated agricultural waste. Treatment of agricultural waste can extract soluble organic compound and enhance chelating efficiency. Although chemically modified plant wastes can enhance the adsorption capacity, the cost of chemicals used and methods of modification will increase the cost of the adsorbent. Beside it can also alter the surface properties of the adsorbent.

In this study unmodified oil palm fiber (UMOPF) and coconut coir (UMCC) will be used as adsorbent for the removal of Cd(II) in aqueous solution by using batch adsorption. The removal efficiencies of these UMOPF and UMCC will be compared with the removal by activated carbon (AC).

5.2 Enhanced Executive Summary

This study deals with the adsorption of Cd(II) from aqueous solution by using two agricultural waste without modification; unmodified oil palm fiber (UMOPF) and unmodified coconut coir (UMCC). Batch studies were performed to evaluate the influences of various experimental parameters like pH, initial Cd(II) concentration and contact time. The adsorption efficiencies were found to be pH dependent, increasing with increasing pH value. The highest removal was observed at pH 7. The uptake of Cd(II) occurred rapidly and the equilibrium was attained around 60 minutes for both adsorbent. The suitability of the Freundlich and Langmuir isotherm model to the equilibrium data were investigated for each adsorbent. The result obtained in this study showed good fit to Langmuir for UMOPF and Freundlich for UMCC. Two simplified kinetic models were tested to investigate the adsorption mechanism. The kinetics of Cd(II) adsorption on UMOPF and UMCC were found to follow the pseudo-second order model. A comparative study with the removal by activated carbon (AC) were also investigated. Comparison of the removal of Cd(II) by these adsorbent with respect to that by AC showed that at low concentration, both UMOPF and UMCC exhibited almost the same performance as AC with removal of almost 99%. The result suggest that UMOPF and UMCC has high possibility to be used as effective adsorbent for Cd(II) removal.