

**REMOVAL OF MANGANESE (MN) AND  
COPPER (CU) IONS FROM INDUSTRIAL  
WASTEWATER USING COCKLESHELL**

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## AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Under Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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## ABSTRACT

The metal manufacturing industry in Malaysia had increased rapidly due to the diverse application in everyday life. This situation had increased the amount of metal pollutant in Malaysia wastewater effluent. The wastewater treatment method had become a great concern in order to provide good water quality. In addition, the abundance of cockleshells waste needs to be utilized as an alternative adsorbent media in wastewater treatment. The potential of the cockleshell to remove Mn and Cu had been studied using adsorption experiment. A continuous batch adsorption study was carried out to determine the optimum dosage with a range of 3g to 24 g of cockleshell, pH value of 4 to pH 10 and contact time from 15 minutes to 150 minutes. The isotherm model was analyzed by using Langmuir and Freundlich model, whereas the kinetic model was analysed by using Pseudo-First-Order and Pseudo-Second-Order. Based on the batch adsorption experiment, the highest percentage removal for Manganese (Mn) and Copper (Cu) using the cockleshell were 77.8 % and 88.9 % respectively with an optimum dosage of 15 g, pH value of 4 and 105 minutes of optimum contact time. The adsorption isotherm process of Mn fits the Langmuir model ( $R^2 = 0.953$ ) while Cu adsorption fits with the Freundlich model ( $R^2=0.959$ ). The interaction between both heavy metals and the cockleshell is chemisorption process due to the adsorption of Mn and Cu suit the Pseudo-Second-Order kinetic model. The analysis of Isotherm and Kinetic model for Mn and Cu indicates that the cockleshell has a great potential as an adsorbent to remove heavy metals in industrial wastewater. In addition, the cockleshell can be used as an alternative replacing current adsorbent in the existing filtration system. Thus, this study helps to increase the economy with modest pace by recycling the low-cost waste for the wastewater treatment purpose aligned with the Eleventh Malaysia Plan (RMK11).

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