

**USING LOW-COST AGRICULTURE MATERIAL FOR HEAVY
METALS REMOVAL FROM AQUEOUS SOLUTIONS**

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REMOVAL FROM AQUEOUS SOLUTIONS**

By

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Increasing the discharge of heavy metals into water streams is of special concern due to their effects on human health and the environment. Most conventional methods for removing heavy metals from water and waste water became inefficient and extremely expensive. Moreover, these methods have many disadvantages such as incomplete removal of contaminants, high reagent and energy requirements and the generation of toxic sludge/waste products that need further disposal treatments. The aim of this research is to investigate the potential of the agriculture waste materials for heavy metals removal from aqueous solutions as they are low cost, eco-friendly, and available in abundance. To achieve the research objective, the low-cost agriculture waste namely rice husk and sunflower husk are utilized as adsorbents for several heavy metals; copper (Cu), iron (Fe), and zinc (Zn). The research follows experimental approach to investigate the effect of husk particle size distribution, husks weight, contact time, pH, and mixing rate of the removal efficiency on the absorption process. The results are compared to the activated carbon, as the common adsorbent, under the same conditions to test their credibility. According to the experiments, the best parameters values are: Weight =20 g, Mixing rate =150 rpm, Contact time=90 min, pH=6.5 and Particle size= 300 μm for various concentrations. The rice husk achieved high percentages removal than sunflower husk, where it

achieved 90%, 90%, and 86% for copper, iron, and zinc respectively for low concentrations. The absorption percentage decreased with the increase of aqueous solution concentrations. The ability of the unmodified rice husk and sunflower is promised compared with activated carbon. Comparing with other studies, the research experiments conditions provide better results. In general, the rice and sunflower husks prove their ability for heavy metals removal and can be considered as a good solution for water treatment.

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APPROVAL

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I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Infrastructure University Kuala Lumpur or at any other institutions.

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CHAPTER 1

INTRODUCTION

1.1 Overview

Around 97.5% of the total available water on earth is salty and is not usable as such; of the remaining 2.5% of fresh water, only a marginal part, 1%, is available for human consumption. Since the distribution of water across the globe is not regular, parts of world are increasingly facing water scarcity. The origin of water scarcity can be natural in some regions because of reduced rainfall or climate changes. The human factor, however, is most critical in aggravating this problem by wasting water, polluting water resources, and/or in appropriately managing water. The world statistics reveal that the total wastewater combining sewage, industrial, and agricultural discharged globally is tens of millions of cubic meters per day. Sadly, a significant portion of all waste water in developing countries is discharged untreated, resulting in large pollution of rivers and other water bodies (Ranade, and Bhandari, 2014).

The water quality has severely deteriorated globally in last few decades, mainly due to the anthropogenic activities, population growth, unplanned urbanization, rapid industrialization and unskilled utilization of natural water resources (Bhatnagar et al., 2015).

As the result of technological development the growth of industries, is an indicator of increased pollution, and a contamination source of continuous environment degradation including air, water, soil and biosphere. Water pollution is one of the global issues that need urgent and effective solutions for healthy environment. The rapid growth of various industries, such as fertilizer, metal plating, tanneries, mining, and textile industries, has increased the discharge of toxic heavy metals into water streams poses significant problems for both human health and the environment. Dyes, paints, printing, photography, paper, and petroleum refining industries also contribute to the presence of heavy metals in effluents (Lesmana et al., 2009; Anbia

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