



**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*

**FACULTY OF ENGINEERING**

**DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING**

**INVESTIGATION OF THE EFFICIENCY OF BANANA PEELS AS AN  
ADSORBENT ON THE REMOVAL OF CHROMIUM ION FROM  
INDUSTRIAL WASTEWATER.**

**CASE STUDY: JAMBO TANNERY INDUSTRY, BUSIA DISTRICT.**

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## ABSTRACT

In this study, chromium was collected from Jambo tannery industry and Banana peels from Busia market. The initial concentration of Chromium was then determined as using Atomic Adsorption Spectrophotometer. Batch experiments were carried out under optimized conditions to evaluate the adsorption capacity of the banana peel in the removal of Chromium from aqueous solutions by varying adsorbent doses, and pH and contact times. The residual Chromium concentrations after bio sorption were analyzed by Atomic Adsorption Spectrophotometer.

The characterization of the banana peel suggested the possible contribution of carboxyl and hydroxyl groups in Chromium bio- sorption .The biosorption efficiency of the banana peel was dependent on the pH of the Chromium solution, with pH 3.5 being optimal. The removal rate of Chromium ions in Chromium eased within contact time and remained constant after an equilibrium time of 6 hours. The removal of Chromium ions in Chromium increased within Chromium increase in bio sorbent concentration with the optimal adsorbent dosage at 3g with 89.3% efficiency. From the covariance test, the banana peelings are very significant and reliable adsorbent that can be used in removal of heavy metal. The present study revealed that banana peel which is a low cost agricultural material could be used as an efficient sorbent for the removal of Chromium from aqueous solutions.

## DECLARATION

I OGWAL WALTER declare to the best of my knowledge that the work presented in here is my own unless otherwise indicated and has never been submitted to any institution for any award.

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**APPROVAL**

This project report was compiled and submitted to the department of Water Resources Engineering under the following supervision;

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## **DEDICATION**

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May the almighty God continue blessing you all. Amen.

## **SYMBOLS AND ACROYMNS.**

AAS: Atomic Absorption Spectrometer

AC: Activated Carbon

DW: Dry Matter

FAO: Food and Agricultural Organization

Mg/l: Milligram per liter

mls: Milliliters

NaOH: Sodium hydroxide

UIRI: Uganda Industrial Research Institute

VOC: Volatile Organic Compound

WHO: World Health Organization.

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## CHAPTER ONE: INTRODUCTION

### 1.1 Background.

Water is essential to all forms of life and makes up 50-97% of the weight of all plants and animals and about 70% of human body (Allan et al., 1995). Water is also a vital resource for agriculture, manufacturing, transportation and many other human activities. Despite its importance, water is the most poorly managed resource in the world (Chutter et al., 1998).

The availability and quality of water always have played an important role in determining the quality of life. Water quality is closely linked to water use and to the state of economic development (Chennakrishnan et al., 2008). Ground and surface waters can be contaminated by several sources. In urban areas, the careless disposal of industrial effluents and other wastes may contribute greatly to the poor quality of water (Mathuthu et al., 1997). Most of the water bodies in the areas of the developing world are the end points of effluents discharged from industries.

Heavy metals are individual metals and metal compounds that can impact human health. These are all naturally occurring substances which are often present in the environment at low levels. In larger amounts, they can be dangerous.

Generally, humans are exposed to these metals by ingestion (drinking or eating) or inhalation (breathing). Working in or living near an industrial site which utilizes these metals and their compounds increases ones risk of exposure, as does living near a site where these metals have been improperly disposed. Subsistence lifestyles can also impose higher risks of exposure and health impacts because of hunting and gathering activities.

The term "heavy metals" refers to any metallic element that has a relatively high density and is toxic or poisonous even at low concentration (Lenntech et al., 2004). "Heavy metals" is a general collective term, which applies to the group of metals and metalloids with atomic density greater than 4 g/cm<sup>3</sup>. However, being a heavy metal has little to do with density but concerns chemical properties.

Heavy metals include lead (Pb), cadmium (Cd), zinc (Zn), mercury (Hg), arsenic (As), silver (Ag) chromium (Chromium), copper (Cu) iron (Fe), and the platinum group elements (Gadd, 1992). The environment is considered in terms of the most tangible aspects like

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