



**BUSITEMA
UNIVERSITY**
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

WATER RESOURCES ENGINEERING PROGRAMME

FINAL YEAR PROJECT REPORT

**INVESTIGATING THE EFFICIENCY OF ORANGE PEEL POWDER AS
AN ADSORBENT FOR REMOVAL OF ZINC IONS IN INDUSTRIAL
WASTE WATER**

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*A final year project report submitted to the Department of Mining and Water Resources
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degree in Water Resources Engineering*

MAY 201

EXCUTIVE SUMMARY

The efficiency of activated carbon from orange peel powder as a low cost adsorbent to remove zinc (II) ions from industrial waste water at steel and tube industry was investigated in this research. The factors of adsorbent load, PH, contact time and agitation rate on the control solution were studied at room temperature. This research showed that orange peel is a good adsorbent for the removal of zinc ions from industrial waste water where by zinc (II) ions uptake increased with increased adsorbent load, pH, contact time and zinc uptake decreased with increase in agitation rate. The maximum uptake of zinc ions was at adsorbent load of 0.25g, pH of 3, and contact time of 120 minutes and agitation rate of 150 rpm achieving an average efficiency of 83.75%.

The economic analysis showed that orange peel powder was more cost effective and achieving the same efficiency of treating zinc from industrial waste water was 17 times cheaper with orange peel powder than with commercial activated carbon.

Hence more economically viable to use orange peel powder to remove zinc (II) ions from industrial waste water.

DECLARATION

I Nabwire Quirinus hereby declare to the best of my knowledge, that this project report is an outcome of my original work and that it has not been presented to any institution of learning for academic award.

Nabwire Quirinus.

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Signature 



APPROVAL

This final year project report has been submitted to the faculty of engineering for examinations with approval of my supervisors.

Main supervisor

Ms. Engole Marion

Signature.....

Date/...../.....

Co supervisor.

Mr. Ddumba Joseph Lwanyaga.

Signature.....

Date/...../.....

DEDICATION

This project report is dedicated to my beloved parents, Mr. Egessa John and Mrs. Nabutono Doreen Egessa in appreciation for their selfless care, guidance, encouragement and support provided to me since my childhood, which attributes I have cherished and made me what I am today.

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I am also grateful to Steel and Tube industries Nakawa and UIRI the chemistry laboratory most especially Robert and Justine for the help and assistance granted to me during the experiments

Lastly I want to thank my parents, friends and fellow colleagues for their knowledge and guidance shared with me during the period of project report writing.

SYMBOLS AND ACRONYMS

AAS	Atomic Absorption Spectrometer
HCl	Hydro Chloric acid
NaOH	Sodium Hydroxide
UIRI	Uganda Industries Research Institute
NaHCO ₃	Sodium hydrogen carbonate
CAC	Commercial Activated Carbon
OP	Orange Peel

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CHAPTER ONE

INTRODUCTION

1.1 Back ground

Environment pollution is one of the critical problems faced by living things. This is as a result of pollution of water bodies such as streams, lakes, underground water with harmful substances that are toxic to living things. Water is essential to life on earth such that all organisms contain it, some live in it and others consume it .some organisms cannot survive in toxic water. (Ministry of water and Environment, 2012).

Waste waters from metal finishing industries contains contaminants such as heavy metals, organic substances and suspended solids. Heavy metals in particular are of great concern because of their toxicity to the humans and other biological life. Heavy metals particularly present in metal finishing waste waters are zinc, lead, copper, chromium, mercury, nickel and cadmium.

The adverse effects of zinc must be balanced against its essentiality. Zinc is an essential trace element that can cause symptoms of deficiency and can be toxic when exposure exceed physiological needs. In an acceptable range zinc is necessary for various metabolic processes like cellular differentiation, embryonic development, metabolism of protein, nucleic acids and in the stabilization of biological membranes. However prolonged exposure of large amounts of zinc can cause various disorders to the body systems like gastrointestinal effects such as abdominal pains, vomiting and diarrhea. Zinc is non degradable in nature thus zinc ions can be carried away to the food chain and thus get accumulated in the living organisms, prolonged consumption of unsafe concentrations of zinc may led to change in biota and destruction of certain species and to human beings continuous consumption of excess concentration of zinc ions can lead to disorders and failure of the kidney, liver, stunted growth, abdominal cramps (Deliyanni, 2009). Zinc occurs naturally in the earth's crust at the required concentrations for living things and therefore always important for industries to removal zinc in their waste water before discharging to the water bodies to maintain the concentration of zinc in the water bodies and on earth. (Spurgeon, 1994).

The conventional physical chemical methods like reverse osmosis, ion exchange, chemical precipitation, chemical coagulation, solidification, electrolytic recovery are used to remove metal

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