BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF WATER RESOURCES AND MINING ENGINEERING

FINAL YEAR PROJECT REPORT

INVESTIGATING THE EFFICIENCY OF MANGO LEAF POWDER AS A LOW COST ADSORBENT TO REMOVE LEAD (II) ION(Pb^{2+}) FROM INDUSTRIAL WASTE WATER

CASE STUDY: KAMPALA PHARMACEUTICAL INDUSTRY (KPI).

APAJO BELINDA MERCY

BU/UP/2012/626

apajobelinda@gmail.com

PROJECT SUPERVISORS

MAIN PROJECT SUPERVISOR: Ms. ENGOLE MARION

CO PROJECT SUPERVISOR: Eng. OKELLO GEATANO PE MASCE MUIPE

This report is presented to the faculty of Engineering as a partial fulfillment of the requirements for the award of a bachelor's degree in Water Resources Engineering of Busitema University.

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EXECUTIVE SUMMARY

The efficiency of mango leaves as a low-cost adsorbent for the removal of Pb(II) ions from industrial waste water at Kampala Pharmaceuticals Industry (KPI) was investigated in this study. The influences of adsorbent load, pH, contact time, initial metal concentration, agitation rate and particle size on a control solution were studied in batch experiments at room temperature. The findings showed that the lead uptake increased with increasing adsorbent load, agitation rate and decreasing particle size. The maximum uptake of Pb(II) ions was at pH 5, contact time of 2hours and that the Pb(II) uptake decreased with increasing initial concentration.

Parameter values were chosen on basis of efficiency and implied cost. These values yielded an average efficiency of 94.48% when used to adsorb lead from KPI waste water.

The economic analysis showed that MLP was more cost effective to treat leaded waste water compared to the commercial Activated Carbon, with MLP being 49 times cheaper than using Activated carbon which cost 2.45 shs.

The results showed that mango leaves have the potential to be applied as alternative low-cost biosorbent in the remediation of heavy metal contamination in waste water.

DECLARATION

I **APAJO BELINDA MERCY** hereby declare that this report is a true work of my hands and has never been presented by any person or institution for an academic award.

Signature: .....

Date: 25th May 2016.

APPROVAL

This project proposal has been submitted to the faculty of Engineering for examination with approval of my supervisors mentioned below;

MAIN SUPERVISOR: Ms. ENGOLE Marion

Signature.....

Date.....

CO-SUPERVISOR: Eng. OKELLO GEATANO PE MASCE MUIPE RE

Signature.....

Date.....

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LIST OF ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
BLL	Blood Lead Level
EBLL	Elevated Blood Lead Level
FTIR	Fourier Transform Infra-Red
GAC	Granular Activated Carbon
HCL	Hydrochloric
IQ	Intellectual Quotient
KPI	Kampala Pharmaceuticals Industries
LDC	Low Developed Country
MLP	Mango Leaf Powder
NAADS	National Agriculture Advisory Services
NaOH	Sodium Hydroxide
NEMA	National Environmental Management Authority
PAC	Powdered Activated Carbon
rpm	revolutions per minute
SBU	Secondary Building Units
US EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
WHO	World Health Organisation

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CHAPTER ONE: BACKGROUND

INTRODUCTION

This chapter contains the background information of the project with details on the current trends of heavy metal pollution and their effects with emphasis on lead. It then explains various adsorption alternatives available and then presents the problem statement, the justification and purpose of the project, the objectives to be fulfilled and then concludes with the scope and limitations of the study.

1.1 Background of the Study

Environmental pollution is currently one of the most critical issues facing humanity. It has increased exponentially in the past few years and has reached alarming levels in terms of its effects on living creatures. Heavy metals are considered one of the pollutants that have direct effect on flora and fauna. Industrial wastewater containing lead, mercury, copper, cadmium, zinc and chromium, for example can contaminate ground and surface water resources and thus lead to a serious water pollution problem (Nagham A. Ageena, 2010;V. C. Renge *et al.*, 2012). Water is a fundamental necessity to all living creatures on earth. Its use ranges from domestic consumption, agricultural and industrial processing, as well as a habitat for various species of plants and animals, and any compromise on its quality leads to serious effects on the health and livelihood of the eco-system.

Heavy metal contamination exists in aqueous waste streams of many industries such as metal purification, metal finishing, chemical manufacturing, mining operations, pharmaceuticals, smelting, battery manufacturing, and electroplating, tanneries, petroleum refining, paint manufacturing, pesticides, smelting, pigment manufacture, printing and photographic industries (Liang *et al.*, 2009; Lu and Gibb, 2006).

Certain heavy metals such as iron, copper, zinc and manganese are required in traces by humans for normal biological functioning. However, heavy metals such as mercury, lead, cadmium are toxic to organisms. Most of the health disorders are linked with specific tendency of heavy metals to bio-accumulate in living tissues and their disruptive integration into normal biochemical processes. These metals are biomagnified along the

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