FACULTY OF ENGINEERING

DEPARTMENT OF WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT REPORT

# ASSESSING THE EFFECT OF POWDERED BIOCHAR ON IMPROVING THE EFFICIENCY OF CERAMIC FILTERS

By

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This final project report is submitted to the Faculty of Engineering in Partial Fulfilment of the Requirement for the award of the Degree of Bachelor of Sciences in Water Resources Engineering of Busitema University

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**ABSTRACT**

Water is a basic need for everyone around the world irrespective of their location or age in all aspects of life and for sustainable development. Therefore, water is a universal goal that the entire world's population has access to water in the right amount, in the right quality and at a reasonable cost (Unicef, 2020). The lack of access to clean drinking water is an alarming public health issue both globally and at the national level. Most people especially in rural areas of developing countries consume polluted water from surface water sources because piped water supply is limited or non-existent due to limited financial resources (Akosile et al., 2020).

Point of use water treatment devices such activated carbon filters, mechanical filters, ceramic filters, lifesaver jerry can, and ion exchange filters have been developed (Venkatesha & Kedare, 2014). Among the point of use water technologies, ceramic water filtration is a promising technology because of its ability to treat water without chemical addition and the use of locally available materials during the production of ceramic filters (Katengeza, et al., 2020).

The objectives of this project were to characterize the mixture of various feedstock materials including powdered biochar in different proportions for production of ceramic filters, to fabricate a ceramic filter based on the characteristics of feedstock mixture, with an optimized proportion of powdered biochar, test its performance efficiency and perform a financial analysis for the optimized ceramic filter. FT/IR-6600typeA was used to characterize the raw materials used in production of ceramic filters and silicate structures (Si-O-Si), alumina (Al-O) and magnesia (Mg-O) octahedral sheets, hydroxyl (OH) stretching vibrations were found in clay. Hemicellulose groups, cellulose groups and lignin groups were found in saw dust and aromatic C=C bonds and aliphatic C-H bonds were found in biochar. Using Design expert, range for both saw dust and biochar were input and gave rise to 13 runs. The optimum mix ratio was found out to be 10%, 17.007% and 72.993% of saw dust, biochar and clay respectively. The removal efficiency for the optimized filter for river water, rain water and tap water were 90.6%, 83.44% and 67.88% for turbidity, 100% for E. coli, 100% for total coliform, 6.61, 7.68, and 6.53 for ph and 66.82%, 27.5%, and 72.8% for hardness respectively.

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Great thanks go to my supervisor, Dr. Resty Nabaterega for the tireless efforts rendered to me during the preparation of this piece of work, may the good Lord bless u so much.

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## DEDICATION

I dedicate this report to all my family members for the love and efforts they rendered to me. They nurtured me in the best way so that I become the person I am today. So may the almighty God bless and reward them abundantly. AMEN

## DECLARATION

I ASHABA EMILY, hereby declare to the best of my knowledge, that this report is an outcome of my efforts and that it has never been to any institution of learning for an academic reward.

Signature: ………………………………….

Date: ……. / ……… / ………..

## APPROVAL

This report has been submitted to the Faculty of Engineering for examination with approval of my supervisor.

Supervisor

Dr. Resty Nabaterega

Signature: .................... Date: 28th - Feb - 2024

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# 1 CHAPTER ONE

## 1.1 Introduction

This chapter presents the general information about the research project giving its background, problem statement, purpose of the study, its justification, objectives, and study scope.

## 1.2 Background

Water is a basic need for everyone around the world irrespective of their location or age in all aspects of life and for sustainable development. Therefore, water is a universal goal that the entire world's population has access to water in the right amount, in the right quality and at a reasonable cost (Unicef, 2020). Even though the relationship between man and water is quite ironic and complex to comprehend, water is critical for human survival because of its undebatable importance in every aspect of life (Unesco & Management, 2019).

According to the World Health Organization (WHO), about 2.2 billion people worldwide lack access to safe drinking water, and approximately 1.8 million people die every year from waterborne diseases (Osiemo et al., 2019). This problem is particularly acute in developing countries such as Uganda, where infrastructure for treating and delivering clean water is often inadequate. This led to an estimated 206 million cases of diarrhea disease in Africa in 2016, resulting in 319000 deaths and 13,433 reported cases of typhoid fever in Africa in 2019, and 221 deaths (Mpindou et al., 2021).

One key technology to combat waterborne diseases in developing countries is the use of water treatment processes, such as chlorination and filtration at household level, construction of water treatment plants, and extension of piped water supply. Additionally, sanitation practices such as the provision of latrines and the safe disposal of human waste, education and awareness campaigns to inform people about the risks of waterborne diseases are also vital in combating waterborne diseases (Osiemo et al., 2019). However, a reasonable number of villages have not been attended to due to limited finance and even in those with the clean water supply, prevalence of water borne diseases due substandard treatment practices and contamination along transmission lines (Ekpunobi et al., 2019 ). Rural areas without piped water supply continue to depend on surface

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