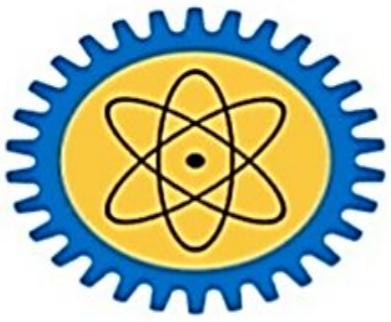

BUSITEMA UNIVERSITY

Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTIMENT OF MINING AND WATER RESOURCES ENGINEERING

INVESTIGATING THE EFFECTIVENESS OF USING SUGARCANE BAGASSE ASH AS A PARTIAL REPLACEMENT OF CEMENT IN CONSTRUCTION OF CONCRETE WATER STORAGE TANKS

BY

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BU/UG/2016/1720

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A research proposal report submitted to the Department of Water Resources and Mining Engineering as a partial fulfillment of the requirements for the award of a Bachelor of Science in Water Resources Engineering

DECLARATION

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

BU/UG/2016/1720

Signature: …….

Date: ……../...……/…...…...

APPROVAL

Am presenting this report to the department of mining and water resources engineering for examination with the approval of my supervisor.

SUPERVISOR

Dr. NIBIKORA IIDEPHONSE

Signature…… Date……/……/…….

MR. TIGALANA DANIEL

Signature…… Date……/……/…….

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ABSTRACT

Bagasse is the fibrous by-product of sugarcane stalks after they are crushed to extract their juice. Sugarcane bagasse ash is a byproduct of the sugar factories found after burning sugarcane bagasse. The disposal of this material i.e. SCBA is already causing environmental problems around the sugar factories**(Basika, Kigozi and Kiggundu, 2021)**. Due to the boost of the construction activity in the country, a huge shortage is created in most of the construction materials especially cement, resulting in steady increase of price. Cement industry also creates environmental problem by emission of carbon dioxide during manufacturing of cement and consumes lot of raw materials. This research was therefore, conducted to investigate the effectiveness of using sugarcane bagasse ash as a partial replacement of cement in construction of concrete water storage tanks.

Initially, bagasse ash samples were collected from SCOUL sugar factory and its mineralogical and chemical analyses were performed with two samples of ash i.e. raw SCBA and calcined at a temperature of 900°C for 24h. After these analyzes, it was observed that the calcined SCBA presented a greater tendency of material in the amorphous state, which possibly made the material the most reactive. For this reason, only the calcined SCBA was used. Also, Sucrose is the chemical name for sugar that comes from the cane and beet sugar plants. Chemically sugar consists of carbon, oxygen and hydrogen atoms and is classified as a carbohydrate. Sugar used in this study as a retarder was sucrose crystals ($C_{12}H_{22}O_{11}$)**(Kandhari, 2017)**. It was obtained from the local market.

Sugarcane bagasse ash was sieved with 150µm sieve size. M25 grade strength of concrete was designed with nine different proportions of concrete mixes. Sugarcane bagasse ash ranging from 5% to 25% in an increment of 10% and sugar ranging from 0.2% to1.0% in an increment of 0.4% by weight of cement respectively including the control mix was prepared with a water cement ratio of 0.5. For each substitution ratio, 3 sets (a total of 60) concrete specimens were prepared for compressive strength test conducted at the age of 7 and 28 days and 20 concrete specimens for water absorption test were casted. The results of the compressive strength of concrete work have shown that up to 15% replacement of the ordinary Portland cement by bagasse ash is possible. In addition, compressive strength value of concrete with 15% SCBA replacement and 0.2% sugar was showing a higher strength improvement of about 8.9%. The water penetration depth was found to increase as the bagasse ash content increases and all the blended concretes showed a higher maximum penetration depth than the control concrete.

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List of acronyms/ abbreviations

SCBA	sugarcane bagasse ash
GBA	ground bagasse ash
ECC	engineered cementitious concrete
OPC	ordinary Portland cement
PPC	pozzolan Portland cement
PE	Polyethylene
PP	Polypropylene
BPA	Bisphenol,
HDPE	High Density Polyethylene,
PET	Polyethylene Terephthalate
SCOUL	sugar corporation of Uganda limited
IS	Indian standards
BS	British standards
EAS	East African Standard
ACI	American concrete institute
SCMs	supplementary cementitious materials
ASTM	American Society for Testing and Materials
ANOVA	Analysis of Variance

CHAPTER ONE: INTRODUCTION

1.1 Background.

Due to the rapid population growth rate in the world today, there has been temporal variation in water to serve different activities **(Population institute 2010).** This is because human population growth is a major contributor to global warming, given that humans use fossil fuels to power their increasingly mechanized lifestyles, this means that there will be variation in water tables due to climatic changes **(Hall *et al.*, 2017).** To overcome the problem of water shortages, water storage tanks should be put in place to ensure water availability in the periods of scarcity.

Water is one of the most integral and important aspects of daily life for every human being **(WHO, 2020).** Therefore, water storage tanks are a must to preserve water for different uses. Water storage tanks can be built in different shapes depending on the choice, and the area provided they also come in different sizes depending on purpose it's to serve.

In Uganda, the common types of reservoir tanks used are plastic reservoir tanks, steel and concrete tanks that are used both as water storage tanks and rain water harvesting tanks. Steel tanks can rust and corrode over time and have a low resistivity to high temperatures. Plastic reservoir tanks are made up of Polyethylene (PE), Polypropylene (PP), Bisphenol (BPA), High Density Polyethylene (HDPE), Polyethylene Terephthalate (PET) etc. These chemicals start mixing with water when used for a long time, high temperature as well as from natural breakdown. When these plastic tanks are exposed to strong heat, especially in the long summer months when the mercury rises above 40oC, the chemicals start to melt down and mix with water. Therefore, Normal Concrete tanks have relatively high resistivity to UV radiations. Concrete has also been investigated however it is more permeable, has a poor workability and poor bonding between steel and concrete thus reinforcement is not Concrete is composed of cement, fine aggregates(sand), coarse aggregates (natural gravel). **(Revanna *et al.*, 2020)**. These constituent materials proportioned are properly mixed together with water to form the concrete. The cement serves as the binder to the aggregates while the aggregates serve as the filler materials that give strength to concrete.

Concrete production utilizes cement as its major ingredient. Cement production is an important consumer of natural resources such as limestone, chalks, marl etc. and energy. Furthermore, the cement industry is a significant CO2 producer which is harmful to the environment and the