FACULTY OF ENGINEERING

DEPARTMENT OF WATER RESOURCES AND MINING ENGINEERING

WATER RESOURCES ENGINEERING PROGRAMME

FINAL YEAR PROJECT REPORT

PROJECT TITLE

INVESTIGATING THE EFFECTIVENESS OF USING MACADAMIA NUT SHELLS AGGREGATE FOR MAKING LIGHT-WEIGHT AND HIGH TEMPERATURE RESISTANT CONCRETE WATER STORAGE TANK.

BY

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A final year project 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

ABSTRACT

Water tanks are containers that can be used for storing water. These tanks are used to provide storage of water for use in many applications like; drinking water, agriculture use as irrigation, fire suppression, agricultural farming, chemical manufacturing, as well as many other uses. Water tank parameters include the general design of the tank, and choice of construction materials, linings. The various materials that can be used for making a water tank include: plastics (polyethylene, polypropylene), fiberglass, concrete, stone, steel (welded or bolted, carbon, or stainless). Amongst the potential available materials for the construction of water tanks is the use of light weight aggregates consisting of Natural materials (like volcanic pumice, scoria and macadamia nut shells), manufacture from industrial by-products (such as fly ash), thermal treatment of natural raw materials (like clay, slate or shale and processing of industrial by-products (such as pelletised expanded slab, i.e. Pellite). In this research study, the use of agricultural wastes was evaluated for potential use as light weight aggregates. Macadamia was obtained from Mushandika village in Kyenjojo district. The macadamia shells were mainly composed of Silicon (iv) Oxide (63.0%), Aluminium Oxide (19.9%) and Iron (iii) Oxide (6.2%). The macadamia shells mix combinations were evaluated at eight (8) levels for potential use as light weight concrete with a slump of between 50-100mm from which the cubes were cast. The minimum macadamia shells-mix combination to achieve 1505kg/m^3 was macadamia mix 30% and this had a compressive strength of 22.4MPa at 28 days. The Normal Concrete (NC) was designed for C25 and this was observed to yield 32.8MPa at 28 days with a unit weight of 2798kg/m^3. With respect to the increase of temperature, the compressive strength and unit weight for all the macadamia shells mix combinations and normal weight concrete were observed to decrease with an increase in temperature. The macadamia shell 30% mix combination was observed to have a compressive strength of 22.4MPa, 22.2 MPa, 20.1MPa and 19.6MPa at 25^0C, 45^0C, 90^0C and 150^0C respectively. The suitable macadamia shells mix combination was obtained at 30% mix which was used in the design and simulation of a RC water tank using TEKLA TEDDs Software.

DECLARATION

I **NUWAHEREZA ONAM,** hereby declare to the best of my knowledge, that this project report is an outcome of my efforts and that it has not been presented to any institution of learning for an academic award.

Signature: …….

Date: ……/……/…...…

APPROVAL

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

SUPERVISOR

MR. MASERUKA BENDICTO

Signature…… Date……/……/…….

DEDICATION

This report is dedicated to my beloved parents in appreciation for their selfless care and unflinching support provided to me since childhood, and for the spirit of hard work, courage and determination instilled into me, which attributes I have cherished with firmness and which have indeed made me what I am today.

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Finally, unconditional love, support and encouragement of my family to continue my effort in difficult times was wonderful, they deserve much love and thanks.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

List of acronyms

ASTM……. American Society of Testing and Materials

ACI ……...American Concrete Institute

BS ……...British Standard

OPC……Ordinary Portland Cement

LWC……...Light Weight Concrete

NC……Normal Concrete