



**BUSITEMA
UNIVERSITY**
Pursuing Excellence

FACULTY OF ENGINEERING.

**DEPARTMENT OF WATER RESOURCES AND MINING
ENGINEERING.**

FINAL YEAR PROJECT RESEARCH REPORT.

**INVESTIGATING THE EFFECTIVENESS OF WATER HYACINTH ASH AS A
PARTIAL REPLACEMENT OF CEMENT IN INTERLOCKING STABILISED SOIL
BLOCKS.**

BY

NAME: FLUJENSIO SSERWANJI.

REG NO: BU/UG/2016/94.

Tel: 0700141839 / 0786443706.

Email: flu Jensio.sserwangi@mail.com

This report is submitted to the department of water resources and mining engineering as a partial fulfillment for a ward of a bachelor's degree in water resources engineering at Busitema university.

ABSTRACT.

This report gives an overview of the practical application of water hyacinth ash as an admixture or a good pozzolan. The study inspired by a study on its chemical composition and realize it was a good pozzolan. Water hyacinth grows vigorously in ponds and double its population within a period of two weeks. Its high rate of proliferation and high environmental tolerance even when disposed of put surface fresh water environments in danger. It focused to determine the effectiveness of water hyacinth as a partial replacement of cement in interlocking stabilized soil blocks (ISSBs). ISSBs block were opted in this research because they provide an economic construction and easily made.

Different mix ratios were made by varying the cement content and water hyacinth ash; - T₁ control (100% OPC), T₂ (10% WHA), T₃ (20% WHA), T₄ (30% WHA), T₅ (40% WHA), T₆(50% WHA). Each treatment, four blocks were made, three for compressive strength and one for water absorption and left to cure for 14 days.

Basing on the results gathered from the tests performed, it showed that using water hyacinth ash as an admixture affected the compressive strengths and water absorption properties of the samples as finding were compared with a conventional block (100% OPC).

It was therefore concluded that increase in water hyacinth ash leads to a decrease in compressive strength of the block. Water absorption increases with increase in water hyacinth ash which compromises the strength of the block. The tests results were done basing on the minimum compressive strength of an ISSB block required and therefore the cement replacement with WHA should not exceed 20%.

DECLARATION.

I **FLUJENSIO SSERWANJI, BU/UG/2016/94** hereby declare that this project report is completely based on my research work of my hand and had never been presented by any other person or institution for an academic award.

Signature:

Date:

APPROVAL.

This work has been compiled with the guidance, consultations and supervision from:

Mr. MASERUKA S BENDICTO.

Signature:

Date:

ACKNOWLEDGEMENT.

I extend my sincere gratitude to Mr. Maseruka Benedicto for the great supervisory work he has rendered towards the success of this research project.

I appreciate my beloved parents Ms. Nakachwa Madrine and Mr. Mbabaali Edward for the invaluable efforts they have sacrificed to see myself on completion of these four years at the university.

Friends and folks, my siblings I can't thank you enough for advices and encouragement I have gotten from you. May God bless us all.

Above all, I thank the Almighty God for great and wonderful job He has done in me to see myself completing these years successfully and enabling me to accomplish my research project.

TABLE OF CONTENTS

ABSTRACT.....	i
DECLARATION.	ii
APPROVAL.....	iii
ACKNOWLEDGEMENT.....	iv
TABLE OF FIGURES	viii
LIST OF TABLES.....	viii
LIST OF ACROYNMS.....	ix
1.0: CHAPTER ONE: INTRODUCTION.....	1
1.1: BACKGROUND.....	1
1.2: PROBLEM STATEMENT.....	3
1.3: OBJECTIVES.....	4
1.3.1: Main objective.....	4
1.3.2: Specific objectives.....	4
1.4: SCOPE.....	4
1.4.1: Conceptual scope.....	4
1.4.2: Time scope.....	4
1.5: SIGNIFICANCE.....	4
1.6: JUSTIFICATION.....	4
2.0: CHAPTER TWO: LITERATURE REVIEW.....	6
2.1: WATER HYACINTH.....	6
2.1.1: Problems associated with water hyacinth.....	6
2.1.2: Efforts to curb water hyacinth.....	6
2.1.3: Beneficial use of water hyacinth.....	8
2.2: CHEMICAL COMPOSITION OF WHA AND ITS EFFECT ON CEMENT.....	9
2.3: INTERLOCKING STABILIZED SOIL BLOCKS (ISSBs).....	10
2.3.1: Definition:	10
2.3.2: Stabilizing agent.....	10
2.3.3: Background to ISSBs.....	11
2.4: MAIN CONSTITUENT MATERIALS USED IN THE PRODUCTION OF ISSBS.....	13
2.4.1: Ordinary Portland Cement as the Main binder.....	13
2.4.2: Soil (For the skeletal structure of the block).....	17
2.4.3: Water (for the hydration of cement and lubrication of soil particles).....	18

3.0: CHAPTER THREE: METHODOLOGY.....	20
3.1: TO CHARACTERIZE RAW MATERIALS.	20
3.1.1: Selecting water hyacinth specie and stage of growth.	20
3.1.2: Test the fineness of WHA and cement.	20
3.1.3: Selecting the best soil site.....	21
3.2: TO DETERMINE THE OPTIMUM PERCENTAGE REPLACEMENT OF CEMENT WITH WATER HYACINTH ASH.....	21
3.2.1: Prepare the soil-cement mixture with addition of WHA.	21
3.2.2: Shrinkage test.	21
3.2.3: Making interlocking stabilized soil blocks.....	22
3.2.4: Compressive strength test.	23
3.2.5: Water absorption test.....	23
3.2.6: Optimum Mixture Design.	24
3.3: TO CARRY-OUT ECONOMIC ANALYSIS.	25
4.0: CHAPTER FOUR: RESULTS AND DISCUSSIONS.....	26
4.1: OBJECTIVE ONE: TO CHARACTERISE RAW MATERIALS.....	26
4.1.1: Preparing water hyacinth ash.	26
4.1.2: Fineness test of cement and water hyacinth ash.	26
4.1.3: Selecting the best soil site.....	27
4.2: OBJECTIVE TWO: TO DETERMINE THE OPTIMUM PERCENTAGE REPLACEMENT OF CEMENT WITH WATER HYACINTH ASH.	30
4.2.1: Linear Shrinkage test.....	30
4.2.2: Making blocks.	32
4.2.3: Compressive strength test.	32
4.2.4: Water absorption test.....	34
4.3.5: Optimum percentage replacement of cement with water hyacinth.....	36
4.3: OBJECTIVE THREE: TO CARRY-OUT ECONOMIC ANALYSIS.	36
4.3.1: Initial Cost.	37
4.3.2: Cash Inflow.....	38
4.3.3: Cash Outflow.....	39
5.0: CHAPTER FIVE: CHALLENGES, CONCLUSIONS AND RECOMMENDATIONS.....	40
5.1: CHALLENGES.	40
5.2: CONCLUSIONS.....	40
5.3: RECOMMENDATIONS	40

REFERENCES.....	42
APPENDICES.....	44

TABLE OF FIGURES

Figure 1: Water Hyacinth Ash.....	26
Figure 2: Linear Shrinkage Mold for testing the Linear Shrinkage.....	31
Figure 3: The effect of WHA on compressive strength.	33
Figure 4: The effect of water hyacinth ash on water absorption.....	35
Figure 5: Collected and chopped water hyacinth	Figure 6: ISSB making machine. 47
Figure 7: Picking an ISSB from a machine.	Figure 8: Compressive testing machine. ... 47

LIST OF TABLES

Table 1: XRF analysis on WHA based on study by Mbugua at al., 2014.	9
Table 2: Showing recorded compressive strength values of different specimens.	23
Table 3: Showing water absorption values for different specimens.....	24
Table 4: Fineness results of cement and WHA.....	27
Table 5: Atterberg limits for different soil samples.....	28
Table 6: Range of Plastic indices and their description (FAO, 1993).....	30
Table 7: Calculated weights of WHA and cement at each percentage replacement.....	32
Table 8: Compressive strength test Results.....	32
Table 9: Water absorption test results.....	35

LIST OF ACROYNMS.

WHA – Water Hyacinth Ash.

XRF – X-Ray Florescence.

MLHUD – Ministry of Land, Housing and Urban Development.

HABRI – Housing and Building Research Institute.

ISSBs – Interlocking Stabilized Soil Blocks.

UNCHS – United Nations Center for Health Settlement.

OPC – Ordinary Portland Cement.

USDA – United States Department for Agriculture.

UN – United Nations.

BIS – Bureau of Indian Standard