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

WATER RESOURCES ENGINEERING PROGRAMME

FINAL YEAR PROJECT REPORT

**DESIGN OF AN ANAEROBIC BAFFLE REACTOR FOR
ABATTOIR WASTEWATER TREATMENT**

(CASE STUDY: TORORO ABATTOIR)

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ABSTRACT

Consumption of contaminated water with pollutants is the major source of sanitation related diseases. Most of these diseases can be eliminated by improving the quality of wastewater flowing into our streams and other waterways.

The primary consideration should be how to eliminate any sort of contact between the people and the untreated waste water or any contaminated water. The objective of this design research project was to come up with an effective abattoir wastewater treatment system using ABR before the water is disposed into the waterways/environment. The proposed system is composed of an ABR.

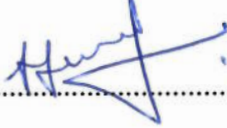
ABR is a high rate anaerobic bioreactor having several compartments. This design promotes spatial separation of acidogenesis and methanogenesis phases longitudinally down the reactor. This makes the reactor very effective in BOD removal and solids retention.

The design was done for a flow of $3.83\text{m}^3/\text{d}$ and the volume of the ABR were found to be 16m^3 with 5 compartments with the first chamber having length of 2.5 m and act as sedimentation zone and the rest each 1m long (1m for upflow chamber and 0.5m for downflow shaft) width of 1m and depth of 2m. The measurements of the open trapezoidal channel were found to be 0.96 m deep and 0.57m bottom width. The wastewater flows at a height of 0.49m and a freeboard of 0.47m were obtained.

The treatment system reduces the BOD from 936.25mg/l to about 97.25mg/l , N from about 171.05mg/l to 100mg/L

DECLARATION

I ICETA Albert declare that this research work is my original work and has not been published or submitted for the award of any discipline to any university or any higher institution of learning before.

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APPROVAL

This piece of work has been checked and approved by;

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Date.....

DEDICATION

This report is dedicated of my beloved parents Mr. & Mrs. Inyani for their wonderful effort and support during the course of my academic carrier

ACKNOWLEDGEMENT

I would like to sincerely thank my supervisors Mr. Joseph Ddumba Lwanyaga and Mr. Mugisha Moses for their guidance and support throughout my proposal and design project write up. Without their assistance, ability to reach this far would not have been possible.

My immense gratitude also goes to Eng. Okello Gaetano whose contribution came in handy during the inception stage of this project. His contribution was also very vital in developing the concept notes and the proposal.

Deep appreciation to the Tororo abattoir management i.e. Tororo Municipal Council for granting access to their premises and giving relevant information about the waste management system used in the past.

Thanks to all my friends and comrades in particular Omwene Philip and Opira Alfred for accompanying me whenever I went to the site for data collection and to all those who contributed, my deepest gratitude.

I am very grateful to my family for supporting me in this whole journey and for being patient with me whenever I was not available because of the busy schedule at school.

Finally and most importantly, I am grateful to God Almighty for the strength throughout this session of the proposal, for the final report write up and the four years I have been at the University.

LIST OF ACRONYMS AND ABBREVIATIONS

ABR:	Anaerobic Baffle Reactor
ACR:	Anaerobic Contact Reactor
AD:	Anaerobic Digestion
ASBR:	Anaerobic Sequential Batch Reactor
BOD ₅ :	5-day Biological Oxygen Demand
BOD:	Biochemical Oxygen Demand
Btu:	British thermal unit
COD:	Chemical Oxygen Demand
DAF:	Anaerobic Air Reactor
EPA:	Environmental Protection Agency
GHP:	Good Hygiene Practices
GMP:	Good Manufacturing Practices
HRT:	Hydraulic Retention Time
NEMA:	National Environment Management Authority
NWSC:	National Water and Sewerage Corporation
NTU:	Nephelometric Turbidity Unit
OLR:	Organic Loading Rate
pH:	Negative logarithm of hydrogen ion concentration
SS:	Suspended Solids
TMC:	Tororo Municipal Council
TSS:	Total Suspended Solids
UASB:	Upflow Anaerobic Sludge Blanket
VSS:	Volatile Suspended Solids
WHO:	World Health Organization

LIST OF FIGURES

Figure 2.1 Schematic cross- section of an anaerobic baffle reactor	6
Figure 3.1: BOD5 under analysis.....	18
Figure 3.2 Procedure Chart.....	19
Figure 3.3: A multi-meter on a magnetic hot plate for determining the TSS	20
Figure 3.4: The pH meter for determining the pH	21
Figure 3.5: Open channel Layout.....	25
Figure 4.1; A graph of rainfall data for Tororo	28
Figure 4.2: A graph of slaughter per day for the sampled four years	30

LIST OF TABLES

Table 2.1: Advantages and disadvantages of ABR.....	8
Table 2.2: Basic design criteria for an anaerobic baffle reactor	13
Table 4.1 Raw Wastewater content	26
Table 4.2: Average temperature for Tororo.....	27
Table 4.3: Projected number of animal to be slaughtered for the 20 years	28
Table 4.4: Recommended side slopes in various type of material.....	34
Table 4.5: Grading results.....	37
Table 4.6: Soil classification using coefficient of uniformity C_u and degradation C_k	38
Table 4.7: Results of economic analysis for the wastewater treatment system	42

Table of Contents

ABSTRACT.....	i
DECLARATION	ii
APPROVAL	iii
DEDICATION.....	iv
ACKNOWLEDGEMENT	v
LIST OF ACRONYMS AND ABBREVIATIONS	vi
LIST OF FIGURES	vii
LIST OF TABLES.....	viii
CHAPTER ONE: INTRODUCTION.....	1
1.1 Background	1
1.2 Problem Statement	2
1.3 Significance of the project.....	2
1.4 Objectives.....	2
1.4.1 Main objective	2
1.4.2 Specific objectives.....	2
1.5 Justification	2
1.6 Scope of the project.....	2
CHAPTER TWO: LITERATURE REVIEW	3
2.1 Treatment	3
2.2 Anaerobic digestion.....	3
2.3 Anaerobic Digestion technology Description	4
2.4 Anaerobic Digestion Processes	4
2.4.1 Hydrolysis.....	4
2.4.2 Acidogenesis.....	5
2.4.3 Acetogenesis.....	5
2.4.4 Methanogenesis	5
2.5 Anaerobic Baffle reactor	5
2.6 Treatment efficiency	8
2.7 Economic analysis for wastewater treatment.....	9
2.8 The design theories.....	11

2.8.1 Chemical oxygen demand	11
2.8.2 Biochemical Oxygen Demand.....	12
2.8.3 Total Suspended Solids	13
2.8.4 Design of the anaerobic baffle reactor.....	13
2.8.5 Flow rate (Q) or daily wastewater generation:.....	13
2.9 Volume of the reactor.....	14
2.9.1 Baffle Reactor Working Volume.....	14
2.9.2 Gas Storage Volume (Vg):	14
2.9.3 Peak up-flow velocity, Vp	15
2.9.4 Design up-flow velocity, Vd	15
2.9.5 Compartment Upflow Area, Au	15
2.9.6 Total Compartment Area, Ac	15
2.9.7 Reactor Depth, Rd	15
2.9.8 Reactor Width, Rw	15
2.9.9 Reactor Length, Rl.....	16
2.9.10 Solid Retention Time (SRT or Φ_x):	16
2.9.11 Substrate Removal Se:.....	16
CHAPTER THREE: METHODOLOGY	17
3.1 Preamble	17
3.2 The characterization of the quantity and composition of abattoir wastewater.....	17
3.2.1 Experimental Procedure	17
3.2.2 Amount of wastewater estimation	21
3.3 Location of the project	22
3.3.1 Geotechnical survey	22
3.3.2 Soil Laboratory Tests.....	22
3.4 The design of individual components of baffle reactor.....	22
3.4.1 Materials and equipment	22
3.4.2 Method of data collection	23
3.4.3 Design parameters for the anaerobic baffle reactor.....	23
3.4.4 Design for the open channel	24
3.5 The economic analysis for the wastewater treatment system	25

3.5.1 Cost benefit analysis.....	25
CHAPTER FOUR: RESULTS AND DISCUSSION.....	26
4.1 Results of the raw Abattoir waste composition.....	26
4.2 Determination of the quantity of Abattoir wastewater contents	28
4.3 SIZING THE ANAEROBIC BAFFLE REACTOR (ABR)	31
4.3.1 Length of the chamber, L_c	31
4.3.2 Width of the chamber, C_w	31
4.3.3 Actual upflow velocity, V_a	32
4.3.4 Actual working volume of the baffle reactor, V	32
4.3.5 Hydraulic Retention Time, HRT	32
4.3.6 Organic load Rate, OLR	33
4.4 DESIGN OF LINED TRAPEZOIDAL CHANNEL	34
4.5 Results of the soil sample test	37
4.6 ECONOMIC ANALYSIS.....	38
4.6.1 Benefits.....	38
4.6.2 Costs involved in project	40
CHAPTER FIVE: CHALLENGES, CONCLUSIONS AND RECOMMENDATIONS.....	43
5.1 CHALLENGES.....	43
5.2 CONCLUSION	43
5.3 RECOMMENDATION	44
REFERENCES	45
APPENDICES	48

CHAPTER ONE: INTRODUCTION

1.1 Background

The abattoir of Tororo is a small-scale business enterprise operated by an Association of independent butchers managed by Tororo Municipal Council (TMC) and it is located in Kasoli Parish Eastern Division Tororo District. The slaughtering area measures 30m² in size, fenced with sand Crete blocks while the floor is made of concrete slab.

Normal abattoir operations are carried out from Monday to Saturday. The blood wash and the process water from the abattoir are channeled directly into Aturukuku River about 160m away from the abattoir slab. For hygienic reasons, abattoirs use large amount of water in processing operations (slaughtering and cleaning), which produces large amount of wastewater. The major environmental problem associated with this abattoir wastewater is the gross pollution of the aquatic environment with increase in waterborne diseases, especially typhoid, diarrhea and dysentery Atuanya *et.al.*, (2012) and also large amount of suspended solids and liquid waste as well as odor generation Gauri (2006).

WHO Abattoir act (1998) defined abattoir as any premises used for or in connection with the slaughter of animal whose meat is intended for human consumption and include a slaughter house, but does not include a place situated on a farm, Bridges *et al.*, (2000).

The continuous drive to increase meat production for the protein needs of the ever increasing population of Tororo which was estimated to about 48900 people, UBOS, 2012; 24/10/2014 has some pollution problems attached. Pollution arises from activities in meat production as a result of failure in adhering to Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) Yahaya *et al.*, (2009)

Effluent from abattoirs has also been recognized to contaminate both surface and groundwater because during abattoir processing, blood, fat, manure, urine, and meat tissues are lost to the wastewater streams, Bello and Oyedemi (2009). Blood, one of the major dissolved pollutants in abattoir wastewater, has the highest COD of any effluent from abattoir operations. If the blood from a single cow carcass is allowed to discharge directly into a sewer line, the effluent load would be equivalent to the total sewage produced by 50 people on average day Aniebo, Wekhe, and Okoli (2009).

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