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FACULTY OF ENGINEERING

DEPARTMENT OF MINING & WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT REPORT

IVESTIGATING THE POTENTIAL OF BIO-GAS FROM SEWAGE SLUDGE

CASE STUDY: TORORO SEWAGE TREATMENT PLANT

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DECLARATION

I OKELLO DENIS OKETTA a student of BUSITEMA UNIVERSITY do here by declare that this project research work is my own and all the contents presented are original except where stated by the references and that the same work has not been submitted for award of a degree at this or any other University or institution of higher learning.

Signature:.......................   Date ..27/05/2016.....................

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APPROVAL

This is to certify that this report was written and compiled by **OKELLO DENIS OKETTA,** registration number **BU/UP/2011/954** on the account of the project research for the award of a Bachelor's Degree in Water Resources Engineering of Busitema University.

Approved by;

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ABSTRACT

Wastewater Treatment Plant (WWTP) plays an irreplaceable role in the overall wellbeing and development of societies. Wastewater treatment is an ongoing process that requires high energy consumption, and this demand contributes negatively to climate change. Nonetheless, there are options available for energy production and recovery in wastewater treatment plants during its treatment process, which can also reduce the negative environmental impacts.

This study aims to investigate the potential of biogas production from sewage sludge, the study site is a wastewater treatment plant situated at Tororo municipality alone Mbale road, operated by National Water and Sewage Corporation (NWSC). The Treatment plant uses open stabilisation ponds treatment system. This process does not allow biogas recovery. The other hand, an anaerobic sludge treatment system can produce energy during its treatment process in the form of biogas that can be captured and converted into energy for treatment use. The research evaluated sludge samples from the Tororo wastewater treatment plant at Jinja laboratory for the characteristics of the sludge. Laboratory batch scale anaerobic digestion studies were also carried out to evaluate the biogas produced. The experimental results showed that sludge samples from the Tororo wastewater treatment plant had a biogas production capacity of 4.93 m^3 per day, with a potential energy production of 15.776kWh. This study had successfully demonstrated the sustainability of an anaerobic treatment process, and concluded that energy production is a feasible option for Tororo wastewater treatment plant.

Keywords: **anaerobic digestion, sewage sludge, biogas production.**

DEDICATION

This report is dedicated to my father **Mr. Oketta Edward** and my mother **Mrs. Magdalene Oketta** for their effort toward my success.

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LIST OF ACRONYMS/ABBREVIATIONS

AD	Anaerobic Digester
BOD	Bio-chemical Oxygen Demand
COD	Chemical Oxygen Demand
GHGs	Green House Gases
HRT	Hydraulic Retention Time
OLR	Organic Loading Rate
PH	Hydrogen-ion Concentration
SRT	Solid Retention Time
TSS	Total Suspended Solid
VFA	Volatile Fatty Acids
VSS	Volatile Suspended Solid
WWTP	Wastewater Treatment Plant

CHAPTER 1: INTRODUCTION

1.1 Background

Biogas production is one of the most important tools that can be used to alleviate the problems of global warming, energy security and waste management (Eyalarasan *et al*, 2013).The increasing demand for power which is between 6% and 8% annually (Rulekere, 2006) due to industrialization and high population growth has affected the country in many ways. Energy consumption level is a good indicator of socio-economic development level of a country because the energy sector has strong impact on poverty reduction through income, health, education, gender and the environment linkages (Sayin *et al*, 2005). In modern times, no country has managed to substantially reduce poverty without greatly increasing the use of energy or efficiently utilizing energy and/or energy services (Rao *et al*, 2010). Thus the use of wastewater treatment plant to boost energy supply in Uganda becomes an important and readily available option. This is boosted up by the fact that there is high increase in the population in Uganda, more especially in urban settings. For example Tororo municipality, the (Uganda Bureau of statistics 2016) results shows a population projection of 41,906 to 43,900 from 2014 to 2016.

The current predominant method of wastewater treatment in Uganda is the use of open wastewater stabilisation ponds (WSPs) where the wastewater is treated under anaerobic conditions producing methane, which is released directly into the atmosphere. The treatment of sewage sludge has a direct implication on the total operation cost of the sewage treatment plant. That is, sludge disposal represents 50% of the total operating costs of a wastewater treatment plant(Appels. *et al*., 2008) . In data provided by John (2015), Tororo WWTP receives an average inflow of 0.177 ML/d of which 0.48% of the total flow is converted in to sludge.

The capacity to generate CH_4 highlights the potential for energy production in all wastewater treatment facilities. There is a good opportunity for energy sustainability in wastewater treatment facilities as energy required to handle and treat waste can be recovered in its processes. In WWTPs, treatment processes produce by-products in the form of stabilized sludge that is a key contributor to energy production by utilizing this form of potential energy, WWTPs can positively contribute to achieving energy sustainability (Abbasi *et al*, 2012).

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