BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION ENGINEERING

DESIGN AND CONSTRUCTION OF A BIOGAS DIGESTER FEEDING SYSTEM

BY

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ABSTRACT

The biogas digester for above ground digesters has to be opened every time it is to be recharged with slurry. This allows entry of air into the system and this directly affects the activity of the anaerobic bacteria. This called for the design and construction of an improved biogas digester feeding system.

The different system components were designed, drawn using solid edge software and fabricated, which were then assembled to form a functioning prototype.

This system pumped slurry into the digester, and is cranked or powered comfortably by right handed person. The system requires one operator when feeding slurry into the digester.

The cow dung and water slurry was mixed in the ratio of 1:1 to give good results in terms of methane yield.

The output capacity of the system was averagely $0.22l/s$ and the efficiency of the system was 35.2%. The system improves on methane yield and concentration in the digester therefore the system is worthwhile for continuously loaded digester.

The system breaks evens in 2.428 years, when evaluated economically. Therefore the project seems to be viable.

DECLARATION

I ***BARAZA Gerald, BU/UG/2012/03,*** declare that this project proposal report is my original work organized with the help of my supervisors and has never been submitted in to any institution of learning for any academic award.

Signed.....Gerald..... ***Date***.....26th - 05 - 2016.....

APPROVAL

This is to certify that ***BARAZA Gerald*** prepared this project proposal under my supervision and is now ready for presentation to the Department of Agricultural Mechanization and Irrigation Engineering of Busitema University for an award of a Bachelors degree of Agricultural Mechanization and irrigation engineering with my approval.

Signature: .....

MR. ODONG ATOCHON Samuel Date.../...../.....

MAIN SUPERVISOR

Signature: .....,

MR. OWAA JOHN Elias Date.../...../.....

CO-SUPERVISOR

DEDICATION

I dedicate this report to my relatives and friends whose tireless efforts in my pursuit for knowledge, continuous encouragement and guidance has enabled me to undergo my internship training successively.

ACKNOWLEDGEMENTS

I would like to extend my sincere gratitude and appreciation to the following persons who, in many ways made my project proposal a successful one.

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I cannot forget my fellow students whose contribution kept me steadfastly committed. And of course finally without further ado I would like to applaud myself for the hard work I put in and keeping my focus on check.

Above all, the Almighty God who has been the craftsman behind every air I breathed for giving me the grace to live and do my research successfully.

LIST OF ACRONYMS AND ABBREVIATIONS

TS- Total solid

VS- Volatile solids

COD- Chemical Oxygen Demand

NH_3-N- Ammonia nitrogen

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CHAPTER I

1.0 INTRODUCTION

1.1 Background

In Uganda, the economic prosperity and quality of life of people are closely linked to their level of per capita energy consumption and the strategies adopted to use energy as a fundamental tool(Amigun et al. 2008). However, in many developing countries (Uganda inclusive), there is over-dependence on biomass (firewood, charcoal and crop residues) as an energy source; according to WEO (2009) report, the disappearance of forest cover leading to a drought in Uganda has left people homeless and without food, with over 90% of energy needs being met by traditional biomass (firewood and charcoal), however, this is not sustainable. There are other alternative energy sources such as petroleum products, biogas and electricity as the driver of economic development (Amigun & Blottnitz Von, 2007). However, of these, biogas is considered the cheapest; production of biogas would not only save the rate of deforestation but also be beneficial for integrated farming systems by converting manure into an improved fertilizer for crops. Other benefits of biogas digestion include; the reduction of manure smell and the alleviation of pathogen thereby improving hygiene on farms, which ultimately leads to an improvement of on farm hygiene according to a report by Ifad (2012).

Several projects in Uganda have tried to promote the use of biogas technologies to help people in the rural areas improve their quality of life by giving them access to a clean source of energy (Kahubire *et al.* 2010). However, among the barriers that prevent their further dissemination is the fluctuations in the amount of gas produced which is brought about by the poor biogas digester feeding methods. In this case the digester has to be opened every time it is to be recharged with slurry. This allows entry of air into the system and this directly affects the activity of the anaerobic bacteria (Liden et al. 2000). Thus resulting into; reactor instabilities, low methane yields and even total reactor failures occur due to oxygen entering anaerobic digesters(Kato et al. 1997).

Therefore, there was a need to limit air entry into the digester when recharging slurry without necessarily opening the digester as it has been the case before. Among the methods of feeding slurry into above ground digesters, manually operated biogas digester feeding system was

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