BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF CHEMICAL & PROCESS ENGINEERING

FINAL PROJECT REPORT

DESIGN & CONSTRUCTION OF A HYBRID RICE DRYER WITH A HEAT RECOVERY SYSTEM

By

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Declaration

I **MAGABO DERICK** declare that the work presented here is out of my own research except where due references are made. It has not been partially or wholly submitted for any academic award to any institution of higher learning any award whatsoever.

SIGN......................................

Approval

This is to certify that this research proposal has been carried out under my supervision and that it is ready for submission to the department.

SUPERVISOR NAME: MRS. KABASA MARY SALLY

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ABSTRACT

Rice (*Oryzae sativa*) is one of the most important foods in Uganda supplying as much as half of the daily nutritional requirements and calories to the Ugandan population. (MAFSC, 2009). About 80% of rice farmers in Uganda are small scale farmers with acreage of less than 2 hectares who use ***poor drying*** methods such as open sun drying involving spreading of the crop on ground, tarpaulin, woven mat and road sides and also, to a small extent, it's done by artificial forced air dryers, these methods are associated with proneness to weather conditions, long drying time and high energy loses due to dryers' inefficient use of energy as almost all the energy input in the dryer is wasted in the atmosphere. This creates a need to design and construct a hybrid rice drier (fired by both solar and biomass) with a heat recovery system which can recover the energy that can be used to preheat the ambient air, and the heating system can then heat the preheated air to a final temperature.

A solar-biomass energy system in this study was developed and achieved through data collection which involved literature surveys and reviews and internet surfing, designing the system components, constructing the prototype which was tested and the results analyzed.
In this project, the solar concentrator gave temperatures of 35^0C, 40^0C and the maximum was 45^0C at noon while the biomass chamber gave temperature increment of 45^0C and 47^0C

The heat recovery system recovered 50% of the temperatures required for drying (35^0C)

Therefore, the dryer was 67.9% efficient and the heat recovery system was 55% efficient

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1 CHAPTER ONE.

1.1 INTRODUCTION

This chapter describes the background information of the project, the problem statement, significance, purpose, objectives and scope of the study. The problem statement describes the research problem and identifies potential causes and a solution. The significance describes the importance of the project. The specific objectives presented will achieve the main objective.

1.2 Background

Rice (*Oryzae sativa*) is one of the most important foods in Uganda supplying as much as half of the daily nutritional requirements and calories to the Ugandan population. (MAFSC, 2009)

According to (MAAIF, 2010), rice is a major source starch, proteins, vitamins and essential minerals in the human health. Uganda's production area is presently 140,000 ha and total annual rice production stands at 140,000 MT of milled rice representing about 70% of the national rice demand estimated to be 200,000 MT (MAFSC, 2009). The eastern region of the country is the leading producer in the country in districts of Kamuli, Butaleja, Iganga, Bugiri, Jinja and Palisa with Palisa and Iganga leading. Iganga producing 31,492 Mt on a total area of 3,676 Ha and Palisa producing 22,865Mt on an average area of 6,247Ha

Fedesele, (2012), rice post-harvest handling and value addition chain involves different unit operations like threshing, ***drying***, milling and packaging. According to the International Rice Research Institute, drying is the process that reduces grain moisture content to level where it is safe for storage. Drying is the most critical operation after harvesting a rice crop. Delays in drying, incomplete drying or ineffective drying will reduce grain quality and result in losses. (IRRI, 2013)

About 80% of rice farmers in Uganda are small scale farmers with acreage of less than 2 hectares who use ***poor drying*** methods such as open sun drying involving spreading of the crop on ground, tarpaulin, woven mat and road sides and also, to a small extent, it's done by artificial forced air dryers, these methods are associated with proneness to weather conditions, long drying time and high energy loses due to dryers' inefficient use of energy because almost all of the energy input in the dryer is wasted in the atmosphere. This creates a need to design and construct a hybrid rice drier (fired by both solar and biomass) with a heat recovery system which can recover the energy

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