

**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*



**FACULTY OF ENGINEERING  
DEPARTMENT OF AGRO PROCESSING ENGINEERING**

**DESIGN AND CONSTRUCTION OF A BIOMASS DRYER FOR MANGOES**

**By**

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**A Research Report presented in partial fulfillment of the requirements for the Award of  
the degree of Bachelors of Agro Processing Engineering of Busitema University**

**NOVEMBER 2013**

## **ACKNOWLEDGMENT**

My sincere thanks go to the Almighty God for the wisdom, knowledge, grace, mercy, and protection He has given me and also to my parents, brothers, sisters, relatives, classmates and friends who have assisted me through guidance and support.

Special thanks also go to Mr. Tumusiime Malachi, Mr. Nuwarinda Timothy and Mr. Kavuma Joseph for all the help and advice rendered during the writing of this report.

I also extend my gratitude to all my lecturers at Busitema University who have equipped me with academic knowledge that has enabled me to succeed in my studies. I sincerely thank Dr. Wandera Catherine and my supervisors Mr. J.D Lwanyaga and Miss Abbo Jacqueline for the support rendered to me in preparation of my project proposal and report.

## **DEDICATION**

I dedicate this proposal report to my parents; Mr. and Mrs. Wandeka who have raised me up, given me financial assistance, parental guidance and counseling plus encouragement in all my academic endeavors.

## DECLARATION

I, MUTONYI WANDEKA CYNTHIA, hereby declare to the best of my knowledge that this report is an outcome of my own work and has not been presented for any academic award in any university, college or higher institution of learning. Throughout the work I have acknowledged all other sources in its compilation

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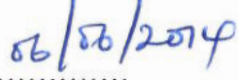
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## APPROVAL

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## ABSTRACT

The mango fruit (*Mangifera* sp.) is a major commercial tropical fruit, grown in many countries of the world. It is less common in Uganda because farmers and processors in our country suffer a problem of high rate of perishability of fruits leading to many losses (Malachi Tumusime 2009) in addition to the capital-intensive cold storage and refrigerated transportation requirements that are beyond their technical capabilities. (Final Draft Report on Citrus Market Study for Teso Sub-Region sponsored by MAAIF-PMA in February 2009.)

This project came up as an attempt to try and solve this problem through the design and construction of a biomass dryer for mangoes. This machine was designed to present an affordable, effective and sustainable tool to small scale processors and farmers for drying mangoes and also address the problem of fruit preservation and value addition to mango produce without many limitations since it utilizes biomass i.e. wood, brickets and dried mango seed covers. (90% of fuel in Uganda) The design followed a particular procedure starting with carrying out a detailed design analysis of the dryer, fabricating the different components of the dryer in form of a prototype, testing the fabricated prototype to determine the efficiency of the machine and its usability for the target group and finally an economic evaluation was carried out to test the machine's cost effectiveness.

The need for the construction of the biomass dryer came as a result of problems faced by mango farmers and small scale processors, all objectives were achieved and after testing the machine was proved to have a maximum temperature achievable of 67<sup>0</sup>C and an efficiency of 67.4%. The machine was also proved to have the ability to remove moisture of 1.38kg from a 1.85Kg batch of sliced mango within 3Hours of constant heating.

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# CHAPTER ONE

## INTRODUCTION

This chapter presents the background of the study and its significance in the development of the Agro processing industry in Uganda

### 1.1 Background of the study

The mango fruit (*Mangifera* sp.) is a major commercial tropical fruit, grown in many countries of the world although the total production of mangoes in Africa is small in comparison to production in other areas of the world. The sale of fresh and dried mango represents an important domestic and export value-added opportunity though their export to Europe and America from Africa represents a formidable challenge since capital-intensive cold storage and refrigerated transportation requirements are beyond the technical capabilities of processors in poorer African nations.

Dried mangoes stabilized though the use of sulphites and added sugar, can be used as an ingredient in many products such as breakfast cereals and granola-type bars. Much of the production of dried mango for the above mentioned markets originates in Asian countries such as the Philippines and Thailand (Robertson 2009) and African processors find it difficult to compete in this market although they have identified large quantities of organically-grown mangoes which when properly processed can help them compete in the European markets.

In Uganda today according to the Final Draft Report on Citrus Market Study for Teso Sub-Region sponsored by MAAIF-PMA in February 2009, dried mangoes are a less capital intensive value-added product that can be easily processed, stored and shipped. The challenge here is that the dried mango processors function only during the high season and directly procure their product from farmers. The research expresses that these processors have set up premises for solar drying; bulk packing and shipping to buyers in Europe and the exporters of dried mangoes have potential to export throughout the year but do not have the quantities of fruit on one hand and efficient technology on the other to rise to a higher scale.

Current techniques are either rudimentary or expensive hence processing is done only during the peak of the mango ripening season. Two consistent exporting firms have focus on the organic

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