BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF CHEMICAL AND PROCESSING ENGINEERING

FINAL YEAR PROJECT

DESIGN AND CONSTRUCTION OF A SMALL SCALE MAIZE HULLER

By

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A final year project report submitted to the Department of Chemical and Processing Engineering as a partial fulfillment of the requirements for the award of a Bachelor of Science degree in Agro-Processing Engineering of Busitema University.

ABSTRACT

Uganda's economy is largely agro-based and with the developing technology it has to meet the needs of the farmers. Uganda has merged to be one of the largest maize producing countries in East Africa and posho or corn meal being one of the staple foods to many regions of the country and maize is one of the most important food crop grown annually around the world and most of it is consumed as processed flour. In Uganda, the local farmers still consume flour that is milled from whole maize grains due to limited hulling machines. The view available maize hullers are on a stand-alone mechanism and this method is tiresome, time consuming, labour intensive, gives less output and involves a high risk of cross-contamination of the hulled grits due to contact with the human body. And some maize hulling machines which exist are expensive which most local processors do not afford hence limiting the production outputs of improved corn flour. Thus, there is a need of a maize huller that saves time, reduce drudgery, and contamination levels while hulling maize due to the increasing demand for the hygienic corn flour by various consumers in Uganda.

Therefore the objective of this study was to design and construct a continuous flow maize huller for small scale maize millers which could therefore help people to hull maize without cross-contaminating and enhance the safety of the prime product. Design and construction of the various components of the maize huller was carried out by analyzing forces acting on them so that components don't fail during operation. Force analysis led to selection of proper materials to withstand the forces to avoid failure. Engineering drawings of the various components of the huller were designed and drawn before the various components were constructed. Then machine assembly was done last according to the engineering drawings and the performance of the machine was tested. In summary, this prototype development of a continuous flow maize huller machine, if implemented, will provide a great remedy to the challenges faced during local hulling processes of maize in various parts of Uganda.

DECLARATION

I **WAFULA ROBERT**, hereby declare to the best of my knowledge, that this project report is an outcome of my original work and that it has not been presented to any institution of learning for an academic award.

Date 30th/05/2017

Signature .....

WAFULA Robert

APPROVAL

This final year project report for the programme of Agro-Processing Engineering has been submitted to the Department of Chemical and Processing Engineering for examination with the approval from the following supervisors.

Supervisors

Signature ..... Date .....

Mr. SSERUMAGA PAUL

Signature ..... Date 15/6/2017

Dr. WANDERA CATHERINE

Signature ..... Date .....

Mr. ASHABAHEBWA AMBROSE

DEDICATION

I dedicate this report to the entire family of **Mr. Henry Musekese** especially my mother **Mrs. Yowanita Musekese** whose tireless effort in my pursuit for their knowledge, continuous encouragement, guidance and unflinching support provided unto me since childhood, and for the spirit of hard work, courage and determination instilled into me, which attributes I have cherished with firmness and which have indeed made me what I am today, may God's WILL be upon them.

ACKNOWLEDGEMENT

To the Almighty God goes the Glory for life, wisdom, knowledge, grace, mercy, and protection He has given unto me since childhood. He is worthy of my praise and worship.

I extend my thanks to all lecturers of Busitema University, Faculty of Engineering, Department of Agro Processing Engineering, who have equipped me with academic knowledge that has enabled me to succeed in my studies and in particular the preparation of this final year project report.

Special sincere appreciation goes to my committed project supervisors **Mr. Sserumaga Paul, Dr. Wandera Catherine** and **Mr. Ashabahebwa Ambrose** for the time, guidance, and support rendered unto me during the project preparations.

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List of Acronyms

FAO	FOOD AND AGRICULTURAL ORGANISATION
FAOSTAT	FOOD AND AGRICULTURAL ORGANISATION STATISTICS
UBOS	UGANDA BEREAU OF STATISTICS
DP	DEPRECIATION
F_O	OPERATION COSTS
H_E	HULLING EFFICIENCY
H_L	HULLING LOSS
CF	CASH FLOWS
PV	PRESENT VALUE
NPV	NET PRESENT VALUE
DF	DISCOUNTING FACTOR
DCF	DISCOUNTED CASH FLOWS
PI	PROFITABILITY INDEX

CHAPTER ONE

1.0 Introduction

This chapter briefly gives the background to the study topic, problem to be addressed by the study, justification of the study, the objective and the scope of the study.

1.1 Background

Maize (zea mays), is a plant belonging to the family of grasses (*Poaceae*). The World Bank estimates that there are about 1.3 million ha of land suitable for maize production in Uganda (World Bank, July 1984 p. 49). Maize occupies the largest area of all crops and is grown by the largest number of households in Uganda. According to Uganda Bureau of Statistics *(UBOS, 2007),* nearly 86% of all smallholder farmers in the country grew maize during the 2005/06 crop seasons. Maize in Uganda is grown both in pure stands (47%) and as a mixture, or intercrop (53%). Smallholder farmers all over the country grow maize for food security and household income.

Industrial dry milling includes particle size reduction (de-hulling and milling) of clean whole maize kernel. According to O. L. Brekke, whole or partially degermed maize products have a short shelf life because of its high fat content, large surface area, and action of native enzymes thus making it susceptible to pest attack. A degerminating process is where the grain kernels are crushed from the thin edges toward the center while avoiding crushing of the relatively flat side surfaces so as to fractures the endosperm under and around the germ and squeezes the germ away from the endosperm in a whole condition *(James Giguere, et al).*

The degree of separation of germ from endosperm that is achieved with conventional degerminating machines is lacking somewhat in completeness and this causes many of the problems that are encountered in the overall milling process. In the Beall degerminator, which is used extensively, the grain kernels are rubbed more against one another than against the metal of the machine. As a consequence, even though relatively good separation of the germ is achieved, a large quantity of fines is generated and the fines are high in fat content since they contain much germ. Impact type degerminators are used for specific purposes such as where finished products having high fat content are acceptable (table meal) and where smaller granulation of the finished products is involved (no large grits). The impact degerminators that have been used in the past

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