



**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*



**FACULTY OF ENGINEERING**

**Chemical and processing Engineering Department**

**DESIGN AND CONSTRUCTION  
OF A DAMPENING UNIT OF THE MAIZE MILLING SYSTEM**

**By**

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## **ABSTRACT**

Maize (*zea mays* L) accounts for almost a half of the calories and proteins consumed in East Africa (Dr. Harold Macaulley, 2015). The maize milling operation is mainly aimed at separating the various components of the maize kernel through the process of dampening, de-hulling and milling. Dampening of maize is the controlled addition of moisture to the maize kernel to create a moisture gradient in the kernel so that the bran and the germ are at higher moisture content than the endosperm. The objective in maize dampening is to optimize the physical conditions of the grain so that a clean separation of the germ, the bran, and the endosperm can be achieved during milling (Larsen 1970, scott 1936, simon 1930).

At local levels dampening of grains by maize millers is not a common practice, though maize millers at kazimungi millers in jinja district add 800 liters of water to every 1000kgs of maize milled using jerry cans before de-hulling and the maize is spread on the ground for around 5 minutes to allow water penetration into the hull. This process leads to an even distribution of the sprinkled water hence making the de-hulling process hard, also the spreading of the maize on the ground leaves the kernels liable to contamination. Therefore this project is carried-out to design and construct a dampening unit of the maize milling system. The maize dampening was constructed to resolve this problem for small scale millers. The dampener adds water to the maize, mixes the maize with the water using the auger and finally tempering of the wet maize in the tempering bin. The NPV value obtained is positive hence the project is highly viable. The efficiency obtained (27%) is low compared to the anticipated value, this is due to the high speeds of the conveying section. The maize dampening unit was constructed running at a capacity of 250 kg/hr. also a maize blower was joined to the dampening unit to deliver maize to the tempering bin. Water was added to the maize successfully and mixed increasing moisture by 0.8%. The maize dampening unit is suitable for small scale millers to improve the entire dampening process and also improve the maize hulling process.

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## **DEDICATION**

To my beloved mother Mrs. Nakigudde Betty, the entire family members and friends for the strength, encouragement and prayers you have dedicated to me, may the almighty God bless you all!

**DECLARATION**

I **Kanakulya Alex**, 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 university/higher institute of learning for an academic award.

Signature .....  .....

Date ..... 30<sup>th</sup> - 05 - 2017 .....

KANAKULYA ALEX



**APPROVAL**

This research proposal report has been submitted to the Department of Agro-Processing Engineering for examination with approval from the following supervisors:

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## **LIST OF ACRONYMS**

**UBOS** - Uganda National Bureau of Standards

**FAO** - Food and Agricultural Organization

**UNIDO** - United Nations Industrial Development Organization

**WEMA** - Water Efficient Maize for Africa

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## 1 CHAPTER ONE: INTRODUCTON

This chapter includes the background of the study, the statement of the problem, the justification, the objectives and the limitations of the study.

### 1.1 Background

Maize is the major source of starch worldwide and is used as a food ingredient either in its native form or chemically modified. Maize (*zea mays* L) accounts for almost a half of the calories and proteins consumed in East Africa (Dr. Harold Macauley, 2015). Maize production in Uganda has increased tremendously to 2,868,000 tonnes in 2014 (UBOS Abstract, 2015) from 1,500,000 tonnes (UBOS Abstract, 2007). Of this, about 90% is used for national human consumption, locally and regional and 10% for feeds.

The maize kernel consists of mainly four parts; endosperm, germ, pericarp and tip carp. What most people consume are broken kernel of the endosperm called the corn grits and corn flour. The maize milling operation is mainly aimed at separating the various components of the maize kernel through the process of dampening, de-hulling and milling.

Dampening of maize is the controlled addition of moisture to the maize kernel to create a moisture gradient in the kernel so that the bran and the germ are at higher moisture content than the endosperm. As a consequence the bran and the germ are more resilient to fragmentation without softening the endosperm (Mehra and Eckhoff, 1997). Dampening involves addition of water of 0.5% to 5% of the weight of the grain kernels at around 10-60 °c and allowed to settle for at least 10 minutes (Yi wang, Hongfu wang, 2015). With dampening of maize more husk components can be removed during the subsequent stage of de-hulling (walter Eugster et al, 2011). The slight surface wetting appears to toughen the pericarp and permits better partial pericarp release, this also promotes easier and better germ release at the time of initial impact (Verl E. Headley, Naperville, III. 1973).

A moist grain is relatively soft and deforms to some extent elastically when pressure is applied. As the force on the grain is increased, a moist grain is capable of retaining more plastic deformation than a dry grain before it breaks hence moist grains produce a range of closer-sized particles as well as fewer and finer particles when forces are applied (*Brian Clarke, Alexandra Rottger, 2006*)

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