BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

CHEMICAL AND PROCESSING ENGINEERING

DESIGN AND CONSTRUCTION OF A MAIZE GRAIN CLEANER

By

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ABSTRACT

Maize (Zeamays) is the third most important cereal grain worldwide after wheat and rice. The importance of maize is centered on the large quantity of Carbohydrates and significant quantities of proteins, vitamins and fats, contained in the kernels, making it compare favorably as an energy source with root and tuber crops.Winnowing and cleaning of grain is usually done prior to storage or marketing if the grain is to be sold directly. For the majority of smallholder grain processors, this process is undertaken manually. It is relatively ineffective from a commercial perspective, since grain purchased from smallholders frequently requires screening to remove stones, sand, and extraneous organic matter. There is little incentive for smallholders to provide well-cleaned grain for marketing, as there is usually no premium for quality; rather, there is every incentive to leave foreign matter in the grain, especially at the bottom of sacks, so that profits from sales can be maximized. Therefore, the objective of the study was to design, construct, test and carry out economic evaluation of a maize grain cleaner for small and medium scale agro- processing units. This would therefore, result in reduced bulk of the material by reducing the level of physical contaminants, thus reducing transport costs and optimizing storage space, safe and longer storage, more out-turn of better quality milled products.

The design of the various machine parts was carried out by analyzing forces acting on them. Force analysis led to selection of proper materials to withstand the forces to avoid failure. Stainless steels of various grades were the main materials recommended to be used because they are food grade, strong and durable. Engineering drawings of the various components were drawn before the various components were constructed and then machine parts fabricated. A fully functional prototype resulted after all the above operations. Testing of the prototype was carried out and the figures revealed that the machine was 75.5% efficient. The maize grain cleaner has a total cost of $\mathbf{1,975,675}$ $\boldsymbol{UGX}$ which includes all the taxes, cost of material, machinery and hired labor to construct the machine plus overhead costs. The cost evaluation analysis of the project was based on the payback period method, the project was evaluated to breakeven in 3 months.

DECLARATION

I **AKAMPWERA AGATHA** declare to the best of my knowledge that this project report is as a result of my research and effort and it has never been presented or submitted to any institution or university for any academic award.

DATE : 31/05/2019

SIGNATURE:

APPROVAL

This project report has been submitted to the department Chemical and Processing Engineering for examination with approval from the following supervisors:

Ms. HOPE NJUKI

SIGNATURE:

DATE:

Mr. ANDREW KIYEMBA

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LIST OF ACRONYMS

FAO - Food and Agriculture Organization

MAAIF - Ministry of Agriculture, Animal Industry and Fisheries

MOG - Materials other than grains

NAADS - National Agriculture Advisory Services

UBOS - Uganda Bureau of Statistics

WFP - World Food Programme

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CHAPTER ONE: INTRODUCTION

1.1 1ntroduction

This chapter briefly describes the historical background of maize as a crop, the problems encountered during its cleaning and gives a justification for the design and construction of a maize grain cleaner in order to reduce on the cleaning losses by improving postharvest grain quality, labor, and increasing income for farmers. It also includes the objectives of the project and its scope.

1.2 Background

Maize (Zeamays) is the third most important cereal grain worldwide after wheat and rice (Golob, *et al.*, 2004). The importance of maize is centered on the large quantity of Carbohydrates and significant quantities of proteins, vitamins and fats, contained in the kernels, making it compare favorably as an energy source with root and tuber crops (Ambrose *et.al*, 2011). Furthermore, maize is referred to as the cereal of the future for its nutritional value and utilization of its products and by-products (Choct, 1997.). Climatically, maize can be produced in most parts of the country except in the most arid parts of Karamoja. The districts with the highest production of Maize are Mubende (1,710,819 tones), Iganga (303,262 tones), Adjumani (47,264 tones) and Kabarole (91,318tones) respectively (*UBOS, 2015*).

However, effective demand of clean grains is gaining potential in the urban areas and the local market is available and it is growing due to increase in rate of urbanization. For grains to be utilized in any form they need to be cleaned which determines the quality, quantity of the cleaned grains as poor methods of cleaning lead to high loss and low quality of grains plus low market value (Ray, 2007).

The traditional methods of harvesting, threshing and postharvest handling of maize grains usually lead into contamination of the product with stones, sticks, chaff, dirt and dust. Materials obtained after threshing include long straws, chaff, small fragments of spikes, leaves and grains. Therefore maize grains, after threshing cannot be stored or used for consumption or as planting material due to the very fact that the presence of long straws, chaff, small fragments of spikes, leaves, dust, dirt and other foreign materials in the grain will accelerate deterioration, thus lead to poor physical condition and the quality of grain becomes eminent. Grain primary processing usually improves grain condition and quality and the process is a vital and necessary link between production, storage and distribution. As a

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