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**DEPARTMENT OF CHEMICAL AND PROCESS
ENGINEERING**

FINAL YEAR PROJECT REPORT

DESIGN AND CONSTRUCTION OF HYBRID SOLAR MAIZE DRYER

By

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Abstract

Maize is always harvested with a relatively high moisture content that makes it impossible to store. To minimize grain losses and thereby increase value and the profit margin of the farmer, a grain dryer is necessary for wet grains. Therefore, this paper presents the design and construction of a hybrid solar maize grain dryer. Properties of maize such as moisture content and bulk density at a particular moisture content were determined to get the required information for design of the hybrid solar maize dryer. The dimension of drying chamber, amount of moisture to be removed in a batch, quantity of air required to effect drying, volume of air required to effect drying, blower capacity, quantity of heat required to effect drying and actual heat used to effect drying were all designed for. A maize dryer was developed with a batch size of 15 kg wet maize grains. The dryer can be used to measure drying rates of maize at different initial moisture contents, drying air temperatures and drying air velocities. The effects of different drying temperature, air velocity, loading and agitating speed on the quality of dried maize can be investigated with the dryer.

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Dedication

To my beloved father Mr. Juma Wilberforce, the entire family members and friends for the strength, encouragement and prayers you have dedicated to me, may the almighty God bless you all!

Approval

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

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CHAPTER: INTRODUCTION

1.1 Background of study

Maize (*zea mays* L.) is an important cereal crop cultivated by about 86 percent of the 4.2 million agricultural households in the country (UBOS 2007). The crop is a staple food for the urban poor, and in institutions such as schools, hospitals and the military. Also, maize is the main source of income for most farmers in Eastern, Northern and north-Western Uganda, who sell it either as grain or when processed into local brew (Ferris S et al, 2006). Therefore, the demand of maize by urban consumers and various institutions has been rising. At national level, maize ranks number-one in terms of food-crop export revenue (MFPED 2002). Nutritionally, maize has a high value. Whole grain of maize of 100grams contains 10grams of protein and 4grams of fat, and provides 360 calories. The germ which is 12% by weight of the whole grain contains 22% of the total protein and 80% of the oil. (Balirwa 1992)

Maize always contains high moisture content (about 35%-25%) which is a favorable environment for the growth of microorganisms such as molds (fungi) and insects' infestation that normally cause grain damage. Drying of the maize must be done to reduce the moisture content to about (11.8%-13%) for safe and longer storage (Folaranmi, 2008; Ndirika, 1988).

Drying involves removal of moisture from an agricultural produce to moisture content in equilibrium with the surrounding air or to such moisture content that can decrease the mold's enzymatic action and insects' infestation. It is a dual process of heat and mass transfer of moisture from the interior of the maize to the surrounding of air (hall 1980). Food stuffs are usually dried to enhance their storability, transportability, texture and retainability.

Currently, the use of solar energy in drying crops by farmers in Uganda involves direct exposure of the crops to the sun and regular turning until it dries sufficiently. Here maize is exposed to a proliferation of fungi, molds and bacteria and soil, hence reducing its quality, maize is also exposed to infestation by animals such as rodents and termites(Mahapatra and Imre 1990).

Postharvest losses of maize in Uganda are very high due to the fact that maize has its season and it is mostly produced in excess of what is immediately needed. These losses are due to lack of appropriate preservation and storage facilities. These losses make the maize unavailable

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