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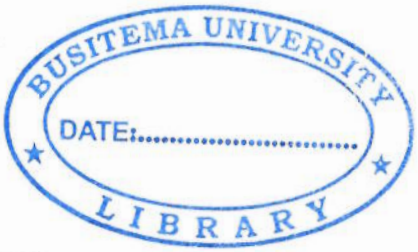

FACULTY OF ENGINEERING

DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING

FINAL YEAR PROJECT

DESIGN AND CONSTRUCTION OF A TEMPERATURE CONTROLLED ELECTRIC SOYBEAN ROASTER

BY

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BU/UG/2015/17

SUPERVISOR: MRS. KABASA MARY SALLY

A final year project report submitted in partial fulfillment of the requirement for the award of the Bachelor of Science in Agro Processing Engineering of Busitema University

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ABSTRACT

Soybean roasting is one of the processing methods of soybeans which increases its palatability by enhancing the release of aromas and flavors. The process inactivates trypsin inhibitors and eliminates allergenic proteins thereby removing the toxicity that is present in raw soybean.

This study was carried out to design and construct a temperature controlled electric soybean to help soybean processors to roast more easily and cheaply in a safe way. The soybean roaster was designed and developed from locally available materials for roasting of soaked soybean and it has a capacity of 2kg/batch, the speed of the agitator is 40 rpm. Soaking helped in softening the texture of the dried soybean which aided the efficient roasting through convective heat transfer. The design of various machine parts was carried out by analyzing forces and effect of heat acting on them which helped in selection of proper materials to withstand the forces and heat to avoid failure. Stainless steel is recommended to be used since it is a food grade material because it is nontoxic and corrosion resistant.

The performance of developed roaster and optimization of roasting time and temperature for soaked soybean was done by response surface methodology. The results showed that the sample size increased linearly in mean diameter and unit mass decreased with decrease in moisture content.

The optimized roasting time and outer temperature of coil in the developed temperature controlled electric soybean roaster is 23min, 30 sec and 200^0C respectively. The developed soybean roaster is suitable for roasting soaked soybean with an efficiency of 73.7%.

DECLARATION

I TWINOMUSINGUZI PRINCESS hereby declare that, this report is a true work of my hands and has never been presented by any person or institution for any academic award.

Signature: .....

Date: 15th May 2019

APPROVAL

This final year project report for the program of Agro-Processing Engineering has been submitted to the Department of Chemical and Process Engineering for examination with approval from supervisor:

Mrs. KABASA MARY SALLY

Signature: .....

Date: .....

DEDICATION

I dedicate this report to the family of Mr. and Mrs. Musinguzi Geoffrey, relatives and friends for their love and continued support in all aspects of life during this journey of education

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First and foremost, I thank the Almighty God who enabled me to do this project and granted me healthy life.

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CHAPTER ONE

1.0 Introduction

This chapter presents the background to the study, problem to be addressed by the study, justification of the study, the objectives and the scope of the study.

1.1 Back ground

Soybean *(Glycine max L)* is one of the world's most important vegetable oil crop (20% of edible oil) and it provides the cheapest source of protein (40%) for both humans and livestock diets (Tukamuhabwa *et al.*, 2017). (Ali *et al.*, 2015) also reported the presence of Calcium, iron, Carotene, phosphorus and thiamine in addition to vitamins A, B, C and D and 20-26% carbohydrates and proteins and oil as well. Soybean according to (Ali *et al.*, 2015) grows best in temperate, tropical and subtropical regions throughout the year as long as water is available.

Soybean originated from East Asia and it was first introduced in Uganda way back in 1908 and in Africa Uganda is the second largest producer of soybean with 16.8% after Nigeria with 48.9% followed by South Africa (14.9%) (Myaka *et al.*, 2005).

(Kagoya, 2014) reported that soybean is one of the most important crops with a huge potential not only to fight hunger and malnutrition but also to generate income and create job opportunities for rural poor people in Uganda and Africa at large. This has attracted many private companies to investigate and engage farmers in its production.

After harvesting, soybeans are either dried naturally (exposing the threshed beans to the sun) or by artifitual means (exposing the beans to forced ventilation of air that is heated to certain degree in special equipment called "dryers"). This is done to lower the moisture content (approximately 12%) in order to guarantee conditions favorable for storage and other further processing heat treatment inclusive or handling of soybean (Islas *et al.*, 2002).

According to (Mateos and Latorre, 2015), (Newkirk, 2010), (Lokuruka, 2011) among others, raw soybeans are toxic to humans due to naturally occurring trypsin inhibitors. However, through processing technologies 95% trypsin inhibitors is inactivated, anti-nutrients can be eliminated in addition to increasing bypass protein content as (Mateos and Latorre, 2015) reported. Heat treatment as one of the processing technologies is considered the most common method in this case and the mechanism by which the heat inactivates these anti- nutrients is known as denaturing.

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