BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF CHEMICAL AND PROCESSING ENGINEERING

DESIGN AND FABRICATION OF A MANUAL TAMARIND POWDERING MACHINE

BY

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ABSTRACT

Value addition in agricultural products is essential for the development of the sector in Uganda (MAAIF, 2011). The study was aimed at achieving this through powdering tamarind flesh. The fruits when ripe contain rust coloured pulp (flesh) which was of major interest in the study. The fruits were deseeded and the flesh dried till crisp for easy grinding. Size reduction by attrition was employed in order to achieve powdering of the dried tamarind flesh.

The major objective of the study was to develop a manually operated tamarind powdering machine which would enhance cheap powdering of the fruit pulp. The powder can be stored easily, has low logistic expenses, more hygienic in preparation, easy to use, convenient as there is no need to bother about disposal of residue as is the case when dry tamarind is soaked in water; and above all has a much stable and longer shelf life because of the lowered moisture content of about 3.5-8.8% (Singh et al, 2007).

Implementation of this project was carried out within a period of four months. Design of the various parts was done by analysing forces acting on them so that components would not fail during operation. Several methods were used in fabricating the different machine components. The methods included cutting, welding, threading, grinding, drilling, chiseling, machining, etc. Components like bearings, shaft, and grinding plates were selected from those available in the market. The machine components were assembled into one unit after they were fabricated.

Testing of the prototype revealed the machine's grinding efficiency as 55.6% for a product size of $1{,}000 - 2{,}000\ \mu m$, capacity as 0.8 kg/hr at inter-plate clearance of 5mm. Total production cost of the machine was 873,000 UGX ($250). It also revealed that the grinding efficiency greatly depends on the moisture content of the feed (dried tamarind pulp), and desired product size of the user which is influenced by the inter-grinding plate clearance. The study also showed that the dried tamarind flesh and powder exhibit hygroscopic properties and therefore need to be kept in air tight containers free from atmospheric moisture content.

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DEDICATION

This report is dedicated to my parents Mr. Erimu Micheal and Mrs. Abeja Faith and to all my family for the love it has shown me throughout my life to this day. It is also dedicated to all my uncles and aunties especially Dr. Akol Zainab, Mrs. Asio Mary and Mrs. Amulen Frances and my beloved grandmothers; Abeja Faith, Atim Pascal and the late Anyait Regina (RIP).

DECLARATION

I, **Erimu Ivan** declare that the work presented in this proposal is my own and has never been presented to any University or higher institute of learning for any academic award.

Signature.....

Date.....25/05/2016.....

APPROVAL

I present this report to the Department of Agro-processing Engineering, Busitema University with approval of the following supervisors:

Mr. Salanjaye Wilberforce

Signature:.....

Date:.....

Ms. Hope Njuki Nakabuye

Signature:.....

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CHAPTER ONE: INTRODUCTION

1.1 PREAMBLE

This chapter presents the general introduction of the study clearly stipulating its background, problem statement, purpose, justification, objectives and scope.

1.2 BACKGROUND OF THE STUDY

The government of Uganda, through the MAAIF, had in its National Agricultural Policy report of September 2013 an objective of promoting specialization in strategic, profitable and viable enterprises and value addition through agro-zoning. This objective was set out to improve the agricultural productivity and post-harvest handling in the country through value addition. Adding value to agricultural products is vital for the development of agriculture in Uganda. The benefits include reducing losses by increasing the shelf life of products, reducing transport costs associated with the movement of unprocessed bulk produce; resulting into increased earnings (MAAIF, 2013).

Tamarind is a tropical widespread multipurpose fruit tree species of the *Fabaceae*, and Genus *Tamarindus* (El-Siddig. 2006). Tamarind, *Tamarindus indica* Linn, is found throughout most of the tropical Africa and the tree grows wild throughout the Sudan. Almost every part of the tree is useful. The most used part of the plant is the fruit (pod). The fruit contains about 30% pulp, 40% seed and 30% hull (Singh et al, 2007). Tamarind products consumed or marketed worldwide include soft drinks, drugs and drug additives, spices, jute, textile or timber, and environmental services are shade, soil fertility improvement and ornamentals. Different parts of the tamarind tree have antioxidant activities. A study conducted by Razali et al, 2012, showed that the tamarind fruit is a potential source of phenolic antioxidants. Tamarind pulp is rich in many phytonutrients that act as powerful dietary antioxidants. According to a study done by Khairunnur et al, 2009, tamarind flesh showed greater antioxidant potential and phenolic content compared to flesh of avocado, jackfruit, and mango. India is the world's largest producer of tamarind products followed by Thailand (Singh et al, 2007). While tamarind is managed for products in countries like India and Thailand, in Africa its products or product markets and populations conservation strategies are not yet developed. Tamarind is also rich in protein,

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