BUSITEMA UNIVERSITY
Pursuing Excellence

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DEPARTMENT OF CHEMICAL & PROCESS ENGINEERING

FINAL YEAR PROJECT REPORT

DESIGN & CONSTRUCTION OF A PINEAPPLE JUICING MACHINE FOR SMALL AND MEDIUM SCALE PROCESSORS

By

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Abstract

The extractor was successfully constructed and tested with an extraction efficiency of 68.6% and capacity of 1600kg/hr and initial investment cost of 1.5M. The machine can be used in production by both small, medium and large scale processors for quick, cheap and hygienic way to extract pineapple fruit juice in a single process due to high extraction efficiency and capacity. Also the machine is cheap and affordable in terms power requirement, its maximum power requirement is 5HP, however, the machine was tried with a 7HP motor and yielded the same results. The pomace, juice and peels were simultaneously separated in a very short time compared to human beings with much lower unit production costs of ugx. 2000 per hour.

The machine was able to separate the juice from pomace and peels without any particles or pomace escaping into the pulp. On the other side however, after testing, the machine had some limitations basically losses such as un-extracted pomace in the crushing chamber with the peels and this amounted to only 7% of the feed. This is the major loss of the machine and it is attributed to the unequal space between the crushing rollers and the perforated frame (squeezing chamber). This loss was seen to increase with the amount of feed in a given time. Also the machine was noticed to make some noise from the crushing unit drive mechanism. This was due to improper meshing of the spur gears used to counter rotate the rollers. During testing, one safety concern was noticed; the open rotating gears, pulleys and belts.

The machine was constructed using mild steel thus Stainless steel for a commercial machine is recommended. Optimization of the squeezing gap between the rollers and the perforated frame to increase efficiency and reduce losses with peels is also recommended and a Crushing roller speed of 600rpm is recommended with the use of imbibition water to enhance the efficiency of the extraction chamber. Faster feeding but the number of pineapple fruits not exceeding 1 is recommended. Fully covering the rotary parts of the machine; the gears, pulleys and drive belts to enhance safety of the machine. Finally, optimization of the crushing roller diameter and the collection chamber volume is recommended to reduce on the volume of the machine and hence its overall weight.

DECLARATION

I **JAKECH BORIS RWOTHOMIO** declare to the best of my knowledge that work presented in this project report is my own and has never been presented to any University or institute of higher learning for any academic award.

SIGNATURE: .....

DATE: 17/05/2015.....

APPROVAL

This final year report has been submitted to the Department of Chemical and Process Engineering for examination with approval from the supervisor.

Mr. kiyemba Andrew

SIGNATURE: .....

DATE: .....

DEDICATION

With great pleasure and gratitude, I would like to dedicate this report to my father **Mr. JAKECH Charles** and my uncle **Mr. ORIBI Bruno Openjuru** for the great unimaginable contribution the have made towards my studies, mentorship in life.

Let me also dedicate this report to my step mums and my Mother **Mrs. JAKECH Jeska Ogentho and Mrs. JAKECH Nakku Faith**, my uncle and **Mr. FELIX UJWANG HELIKIA** and my brother **Mr. Jakech Sunday Alinya,** family members, lecturers, teachers, friends and all people who have helped me in one way or the other. May God grant you Blessings in your life and the life hereafter, AMEN

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CHAPTER ONE

1.0 Introduction

This chapter presents the general information about the project giving its background, problem Statement, justification, objectives, and scope of the study.

1.1 BACKGROUND

Pineapples are by far the most developed and widely grown commodity in the fruit crop range and value chain in Uganda **(Kiaya, 2014).** Current fruit production is purely in the hands of smallholders centered in the Southern, Central and Eastern regions. Current production is estimated at 5000 acres (2000 ha) on 2500 smallholdings **(Kiwanuka, 2017).**

Pineapples are highly perishable like the majority of fruits. This is due to their high moisture content estimated to be over 80% **(Sharma, Chen, and Vu Lan, 2009)**. They require immediate consumption after harvest, or processing and refrigeration if they are to be consumed later.

The surplus or the unsold is left to rot leading to wastage **(Namuwoza and Tushemerirwe, 2011)**. In developing countries, the perishability of pineapples leads to high post-harvest losses (over 50 % in Uganda) **(Emmanuel Wokulira Miyingo et al. 2017).** Apart from extending shelf life, processing reduces losses and wastage in the supply chain of pineapples **(Kiaya, 2014).**

However, the industrial pineapple fruit juice production involves a large-scale processing plant which requires high capital investment for construction of the processing plant, acquisition of heavy electric machinery, high operation and maintenance costs **(Salim et al. 2014).** Local pineapple fruit processing industries mostly use a long and tedious process involving increased material handling with at least two standalone machines **(Baseke, 2011).** And the production methods involved leads to a lot of wastage and low product yield **(Sharma et al, 2009).**

1.2 PROBLEM STATEMENT

Production of pineapples in Uganda among local medium-scale pineapple processors currently entail batch processing. This rudimentary method is tedious as it comprises peeling, crushing, and squeezing involving at least two different standalone machines.

This leads to long exposure time of the pulp to non-aseptic conditions which increases pulp susceptibility to contamination (Kiwanuka, 2017); there is increased material handling (Baseke, 2011); the method is time consuming and labor intensive hence costly with very low output at any

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