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UNIVERSITY**  
*Pursuing Excellence*



**FACULTY OF ENGINEERING**

**DEPARTMENT OF CHEMICAL AND PROCESSING ENGINEERING  
BSc. AGRO PROCESSING ENGINEERING**

**DESIGN AND CONSTRUCTION OF A GRAPE DESTEMER CUM  
CRUSHER**

**BY**

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## ABSTRACT

Grapes are fruits, botanically called *Vitis vinifera*, and are one of the world's largest fruit crops, with the highest input of technology.

Grapes can be eaten fresh as table grapes or they can be used for making wine, jam, juice, vinegar, and grape seed oil.

This project was designed and constructed to help the local farmers, small and medium scale industries to improve on the quality of their wine which would yield high market prices hence improving their economic wellbeing and this was achieved by destemming and crushing the grape fruits.

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 84.3% efficient. The grape destemmer cum crusher has a total cost of 1,690,000UGX which includes all the taxes, cost of material, machinery and hired labor to construct the machine; the cost evaluation analysis of the project was based on the payback period method, and on net present value method with NPV of 105,894,000 UGX over a period of three years

**DECLARATION**

I **MUJUNI BRIAN JOSEPH** hereby declare to the best of my knowledge that this is my true and original piece of work and has never been submitted to any university or institution of higher learning by anybody for any academic award.

MUJUNI BRIAN JOSEPH (BU/UG/2015/13)

Signature.....*Mujuni Brian Joseph*.....

Date .....*15<sup>th</sup> / may / 2019*.....



## **APPROVAL**

This final project report has been submitted to the faculty of engineering Busitema University for examination with approval from:

**Main supervisor**

**Mr. SERUMAGA PAUL**

Signature .....

Date.....

## **DEDICATION**

This report is dedicated to my beloved Brothers Nicholas and Mike in appreciation for their selfless care and parental support provided to me and for the mentorship of hard work and determination delivered to me, which attributes I have cherished with firmness and which have transformed me to this level

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## ABBREVIATIONS AND ACRONYMS.

MS- Mild steel.

RH – Relative Humidity.

FAO – Food and Agricultural Organization

ROCI – Return On Capital Invested.

NPV - Net Present Value

ASTM – American Society for Testing and Materials

ASME – American Society of Mechanical Engineers.

$\rho$  - Density

T - Torque

$\omega$  – Angular Velocity.

g – Acceleration due to gravity

## CHAPTER ONE: INTRODUCTION

### Over view

This chapter gives a rationale background of the topic under study. It also contains the problem statement, objectives of the study, justification, purpose, scope and limitation of the study.

### 1.1 Background of the study

A grape is a fruit, botanically called *Vitis vinifera*, of the deciduous woody vines of the flowering plant genus *Vitis*. Grapes are one of the world's largest fruit crops, with approximately 75 million tons annual production on a surface area of 7.5 million hectares (Foithn, 2012). A grape is one of the fruits with the highest input of technology (cooling, sulfuration, packing, cold storage) and practices (hand labour). For this reason, it is the fruit crop with the highest total value of production in the world, representing almost 70 billion of US\$. (Zabadal., 2002).

Grapes can be eaten fresh as table grapes or they can be used for making wine, jam, juice, vinegar, and grape seed oil. (Providência, 2006) . The leading producer and consumers of grapes is china with a percentage of about 34% followed by India and Turkey producing 8%, with 50% going to the rest of the world.

Grape consumption is not only on the rise in these countries; there is an increase of consumption in East Africa. In Uganda, there is an estimated production of 7000MT annually. Grapes are mainly grown in the western region because of the favorable climate and the sloping hills of the valleys, which offer proper drainage of the vineyards i.e. Kanungu, Kabale, Mbarara, Rukungiri, Kasese and Bushenyi (Mukiila 2016).

In 2014, 44% of the grape production consisted of un pressed grapes, while the other 56% was mainly used for wine production (Thomash, 2006).

Moderate red wine consumption from fermented grape juice is associated with significant reduction in cardiovascular disease, stroke and cancer among men. Wine is also a mild natural tranquilizer, serving to reduce anxiety and tension (McGovern, 2013).

However, before fermentation, two operations are carried out i.e. destemming and crushing of the grape fruits. Destemming consists of separating grapes from the herbaceous parts of the clusters and the stems that are unnecessary. Traditionally, grapes are destemmed using hands, by rubbing them on crates to separate them from fruits and crushing them by using hands, stomping by feet and using single roller crusher machines. However, these methods are time consuming, costly in

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