BUSITEMA UNIVERSITY
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FACULTY OF ENGINEERING

DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING

AGRO-PROCESSING ENGINEERING PROGRAMME

FINAL YEAR PROJECT REPORT

DESIGN AND CONSTRUCTION OF AN INTEGRATED HONEY PROCESSING MACHINE

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ABSTRACT

Honey is the most important primary product of beekeeping both from a quantitative and an economic point of view. Honey equally has colorful variety of uses in other products for example in bakery, confectionery and in manufacturing of cosmetics. Because of these important reasons, honey is being extracted (collected) to meet the demand both in raw form or as valued added to other products using rudimentary methods by the local beekeepers, this methods are inefficient and time consuming. Various extractors that are used for honey extraction exist world wide ranging from manual operated to automated honey extractors, but they are expensive to be afforded by the local honey processors in Uganda.

The poor extraction and filtration processes of honey processing by the existing methods which have led to increased demand for high value honey in the markets warrants the development of low cost, locally made and portable integrated honey extractor that can be accessed by the honey farmers. This study therefore aimed at developing of a honey processing machine that integrated the processes of honey processing: extraction, filtration, and clarification with heating mechanism. The availability of this machine improves the extraction and filtration processes - relief the honey farmers of their drudgery in producing honey, create self-employment for the jobless and finally increase the economy of Uganda through exportation of this honey and its products. The physical characteristics of the extracted honey (absence of defects, flavor & aroma, clarity, and viscosity) were considered during the design and construction of this machine. The design was made simple and manually operated which can be installed at home or farm where breeding of honey bees is possible. It is a pulley and bevel gear- driven system with pulley of small diameter of 70mm and big diameter 210 mm; and bevel gears of 1:1 gear ratio. The pulley system was mounted through bevel gear shaft onto a vertical central solid shaft of diameter 24 mm; to this shaft was the honey comb frame holder of radial- shape with four segments were welded. A full turn will give the frame holder housed in a cylindrical container (drum) speed of 185 rpm when loaded. While the design driven force is 1138.89N. The mass of honey collected was 2.03kg in 22 minutes, while when using hand pressing, it takes 1- 2 hours when 12 kg of honey combs are extracted. This proved the local fabricated extractor to be 34.5% relative efficient on half-load of its capacity. The filtered honey was reasonably clear, with a good aroma as compared to the one collected by hand pressing. The cost of production was Ug.Shs 474500; this amount took care of bought out component, machining, non- machining, and material costs. The only limitation is that it is not electrically driven; has the advantage of being used in both urban and rural areas where there is no electricity.

DEDICATION

This work is dedicated to my beloved mum-Akello Majeri and little sister-Majeri for their tiresome less support and prayers to my education. May the Almighty God bless you abundantly.

DECLARATION

I Emmanuel Oluka, BU/UG/2011/148, hereby declare that this research project report is my original work and has not been previously submitted to any other institution of higher learning for any academic award. I further declare that all sources cited are acknowledged by means of a list of references.

EMMANUEL OLUKA

Date.....21/07/2015.....

APPROVAL

This project report has been submitted to Faculty of Engineering for examination with approval from the following supervisors:

Mr. Paul Sserumaga

MAIN SUPERVISOR

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LIST OF ACRONYMS

FAO – Food and Agriculture Organization

DIMAT – Development of Inclusive Markets in Agriculture and Trade

UNDP - United Nations Development Programme

HMF - Hydroxymethylfurfural

NAFIS - National Agriculture and Food Institute of Science

UBOS - Uganda Bureau of Standards

SAIAE - South African Institute of Agricultural Engineers

MACRS - Modified Accelerated Cost Recovery System

GDS - General Depreciation System

BCR - Benefit Cost Ratio

PW - Present Worth

AW - Annual Worth

Rpm - Revolutions per Minute

HDPE - High Density Polyethylene

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extractors are available in the local Ugandan markets but their hand-powered mode of operations prove to be inappropriate due to the fact that gear oil can easily spill into the extracted honey resulting in deterioration of honey quality and small quantities of honey is extracted (Saville, *et al.*, 2000). The existence of such impurities in the extracted honey has effect on human health for example botulism in infants which causes paralysis and death; there is also a risk of food poisoning when impure honey is consumed (Luther, 2013). In addition, automatic programmable and electrical driven extractors have been developed in advance countries, but their costs are high for a beginner honey processor/ beekeeper to afford (Akinnuli, Abadariki & Fasan, 2013). Therefore many local beekeepers are faced with the challenge of extraction and filtration of their honey within a short time span due to unavailability of low-cost modern extractors to be used.

This study therefore aims at addressing the problem of poor extraction and filtration of honey through availing an integrated honey processing machine that is able to combine all the honey processing units (that is; extraction, filtration and clarification) with a heating mechanism incorporated into the machine. The development of an integrated honey processing machine with a heating mechanism enhances high productivity of the honey, reduces the time spent in the extraction process and enhances value addition to the extracted honey thus increasing its appreciation by consumers as a high value product. The study was limited to designing the honey processing machine, constructing the prototype and testing its performance; and making a return on investment and cost benefit evaluation of the prototype.

1.2 Problem Statement

In Uganda, honey processing is often accomplished using rudimentary methods which are inefficient and time consuming. This has resulted into deterioration in the quality of the extracted honey due to poor extraction and filtration processes. The available low cost manual extractors on the markets still affect the quality of the extracted honey that is its aroma and flavor due to gear oil spills from the manual operation mechanism. However, a series of automated honey extractors that exist in the global markets have improved the extraction and filtration processes but they are expensive to be afforded by the local beekeepers.

1.3 Purpose of the Study

The study dealt with improving the honey extraction and filtration processes by the small scale honey processors without jeopardizing the quality of the extracted honey.

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