

Subject Summary of Project of Cassava peeling machine
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Technical Report

Design and Development of a Cassava Peeling Machine
with 75% Test Efficiency
(A Raw Materials Research and Development Council
(RMRDC) Funded Project – 2007)

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Project Location: Ibadan, Oyo State, Nigeria

Programme: Student Industrial Work Experience Scheme
(SIWES)

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Abstract

This report presents the design, fabrication, and performance evaluation of a cassava peeling machine developed under the Raw Materials Research and Development Council (RMRDC) grant for cassava utilization without waste. The project was executed in Ibadan during the SIWES programme (2007) by Ganiyu Akeem Kolawole, a 400 Level Agricultural Engineering student at LAUTECH, under the supervision of Engr. Adewunmi Taiwo (Senior Lecturer, LAUTECH).

The design aimed at addressing the inefficiencies of manual cassava peeling by integrating mechanical engineering principles such as machine design, material selection, kinematics, power transmission, and tribology. Experimental testing yielded an average peeling efficiency of 75%, marking a significant improvement in processing capacity and labor reduction for cassava-based industries.

Introduction

Cassava (*Manihot esculenta* Crantz) is a critical staple crop in Nigeria and across sub-Saharan Africa. Despite its potential, the peeling process has been a major bottleneck in cassava utilization, traditionally relying on manual labor that is time-consuming, unsafe, and inefficient.

In 2007, the Raw Materials Research and Development Council (RMRDC) funded a cassava utilization project with the objective of designing a mechanical cassava peeling machine that would:

- a. Minimize processing time.
- b. Reduce post-harvest losses.
- c. Enhance industrial cassava utilization without waste.
- d. Improve efficiency through mechanization.

This project was carried out in Ibadan as part of a Student Industrial Work Experience Scheme (SIWES) programme by Ganiyu Akeem Kolawole, and technically supervised by Engr. Adewunmi Taiwo of Ladoke Akintola University of Technology (LAUTECH).

Objectives

1. To design and fabricate a cassava peeling machine suitable for small-to-medium scale processing industries.
2. To apply mechanical engineering design principles in achieving durability, safety, and high efficiency.
3. To experimentally evaluate the machine's performance and determine its peeling efficiency.

Methodology

- Design Considerations

Material Selection: Stainless steel was chosen for food-contact surfaces due to corrosion resistance and compliance with food safety standards. Structural members were designed from mild steel to reduce cost while ensuring rigidity.

Kinematics & Motion Transmission: The peeling chamber utilized a rotary drum mechanism with abrasive linings. Power transmission was achieved via a belt and pulley drive system, ensuring controlled torque and speed.

Tribology: Surface roughness of the peeling drum was optimized for effective skin removal while minimizing tuber wastage.

Ergonomics & Safety: Shielding of rotating parts and operator-friendly loading/unloading points were integrated.

Design Calculations

Power Requirement (P):

where T = torque (Nm), ω = angular velocity (rad/s).

Capacity (Q):

where M = mass of cassava peeled (kg), t = time (s).

Efficiency (η):

where, W_p = weight of cassava peeled, W_t = total weight fed.

Fabrication Process

Frame construction via arc welding of mild steel profiles.

Machining of rotary drum and shaft on a lathe machine.

Assembly using bearing housings, couplings, and fasteners.

Surface finishing and installation of safety covers.

Performance Evaluation

The machine was tested using freshly harvested cassava tubers under controlled conditions.

Average Input Capacity: 50 kg/hour.

Average Peeling Efficiency: 75%.

Peeling Time Reduction: 65% compared to manual methods.

Tuber Loss/Wastage: < 10%.

Maintenance Requirement: Minimal; lubrication of bearings and belt tensioning.

Discussion

The prototype achieved its design objectives by demonstrating substantial improvement in processing efficiency. The mechanical abrasive drum effectively handled non-uniform cassava sizes, although optimization of the abrasive surface texture is recommended to reduce tuber loss.

The project highlighted key mechanical engineering applications:

Machine Design & Solid Mechanics in frame and shaft dimensioning.

Power Transmission Systems via belt-pulley arrangements.

Ergonomics & Safety Engineering in operator interaction.

Materials Engineering for food safety and durability.

Conclusion

The RMRDC-funded cassava peeling machine project successfully demonstrated the application of mechanical engineering design to agricultural productivity. With a 75% test efficiency, the machine offers a viable pathway to scaling cassava processing, improving food security, and reducing post-harvest waste.

Recommendations

Scale-up of design for industrial production.

Integration of automatic feeding and discharge mechanisms.

Application of finite element analysis (FEA) for future optimization.

Exploration of renewable power sources (e.g., solar-driven motors) for rural deployment.

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Keywords

Cassava peeling machine, mechanical engineering design, abrasive drum, RMRDC, efficiency, agricultural Engineering ,Ibadan, LAUTECH, SIWES.