Available *online* at: https://journal.gioarchitect.co.id/index.php/localengineering/issue/current

**Local Engineering**

Journal of Local Architecture and Civil Engineering

| Doi: 10.59810/localengineering | ISSN (Online) 2987-7555 |

Civil Engineering – Research Article

# Development and Performance Evaluation of a Cassava Mash Pulverizing-Cum-Sieving Machine

*Oladimeji A. O., Fawohunre A. J., Olajide O. G.*

*Department of Agricultural and Bio-Environmental Engineering Technology, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria*

ARTICLE INFORMATION

Received: August 11, 2025
Revised: October 16, 2025
Available online: December 01, 2025

KEYWORDS

Cassava, machine design, performance evaluation, pulverizing, sieving

CORRESPONDENCE

Oladimeji A. O.

E-mail: azeeztreasure@gmail.com

A B S T R A C T

Cassava (Manihot esculenta) remains a key staple crop in Nigeria, yet its post-harvest processing continues to face inefficiencies due to manual methods. This study aimed to design, fabricate, and evaluate the performance of a cassava mash pulverizing-cum-sieving machine to address issues of human drudgery, low throughput, and contamination. The machine comprises a hopper, pulverizing chamber, rotary sieve, electric motor, and support frame. Operational testing was carried out at three speeds: 400, 500, and 600 rpm. Results indicated improved sifting efficiency and capacity, with design parameters tailored for durability, portability, and simplicity. This dual-purpose machine demonstrates potential for local cassava processors in Nigeria to enhance productivity and product quality.

## INTRODUCTION

Cassava serves as a major source of carbohydrates in most developing nations and is particularly vital in Nigeria, the world's leading producer (Olaniran & Adeleke, 2018). Traditional processing methods involving tools like grinding stones and pestles are labor-intensive and often unhygienic (Adetunji et al. 2013). Mechanization, through tools such as graters, sifters, and fryers, has been increasingly adopted to address these shortcomings (Adetunji and A.H. Quadri 2011). Cassava mash sieving is particularly crucial in the production of gari, a widely consumed cassava product across West Africa. (Kudabo, Onipede, and Adegbenro 2012; Sanni, Ogunsina, and Oladigbo 2008). However, the high cost and limited availability of imported machinery hinder adoption among small-scale processors. This study presents the design and performance evaluation of a cost-effective, locally fabricated cassava mash pulverizing-cum-sieving machine.

### Problem statement

Manual processing of cassava mash poses multiple challenges including human fatigue, time inefficiency, contamination, and poor product quality. Imported machines are often financially inaccessible. A locally developed dual-function pulverizing-cum-sieving machine would mitigate these issues, facilitate learning among students, support institutional research, and contribute to Nigeria's cassava industry.

### Objectives

The primary objective is to develop a cassava mash pulverizing-cum-sieving machine. Specific goals include: Designing the machine components, Fabricate the machine and to Evaluate its performance based on sifting capacity and efficiency.

### Literature review

Several researchers have examined cassava processing equipment. (Mohammed et al. 2015) developed a pedal-powered pulverizing-sieving machine with moderate efficiency but low output. (Oladipo et al. 2016) designed a reciprocating sifter operating at 2400 rpm, yielding a 95.77% recovery rate. Agbetoye and Oyedele (2007) reported only 48.6% efficiency using a rotary sieve. Adejumo and Ola (2010) found that sifting efficiency decreased with increased load in a combined post-grinder. (Tambari et al. 2015) observed a 75% efficiency in a reciprocating sieving machine, while (Adetunji et al. 2013) achieved 92% in their improved sifter. These findings underline the need for more efficient, low-cost dual-purpose machines.

## METHODS

**Machine description**

The machine comprises a trapezoidal stainless-steel hopper, 60x60 mm angle iron frame, pillow bearings, galvanized sieve, and dual belt system for transmitting motion. The electric motor drives the pulverizing chamber and sieving unit.

**Operation principle**

Cassava mash is fed through the hopper into the pulverizing unit, where beaters break it into finer particles. The mash then enters the rotary sieving drum, and the sieved product is collected from a lower tray, while chaff exits through a separate outlet.

**Design considerations**

The machine design emphasized minimal power requirement, rigidity, durability, simplicity, and portability. Bearing alignment and frame stability were considered to minimize vibration.

**Design calculations**

Power Requirement: As given by (Hall, Holowenko, and Laughlen 1982), the power required depends on shaft speed and load.
Hopper Capacity: Inclination angle calculated using Bucklin et al. (2003): $\alpha = \tan^{-1} \mu$
Belt Design: Based on Indian Standard Code (IS 2494-1974), with equations for belt length and wrap angles (Sadhu, 2004; Hannah & Stephen, 2004).
Shaft Design: Shaft diameter and speed were calculated using (Khurmi and Gupta 2005; Mathew, Hoseney, and Faubion 1999).

**Performance evaluation**

The machine was tested at three speeds: 400, 500, and 600 rpm. For each test, the mass of cassava mash processed, time taken, and residue weight were recorded. Performance metrics include:
Sifting Capacity (SC): $SC = m / t$
Sifting Efficiency (SE): $SE = (m - c) / m$, where m is the mass of mash and c is the residue.

## RESULTS AND DISCUSSION

The fabricated machine demonstrated satisfactory performance. Across all speeds tested, the sieving unit effectively separated fine mash from chaff. The highest efficiency was observed at 500 rpm, balancing speed and product integrity. These results align with the findings of (Adetunji et al. 2013; Oladipo et al. 2016), affirming that optimal machine speed and loading can significantly enhance sifting efficiency.

## CONCLUSION

The cassava mash pulverizing-cum-sieving machine provides a viable solution to the challenges in cassava processing. It is efficient, durable, and suitable for local use in research and commercial settings. Its deployment can reduce processing time, human labor, and improve product quality, thereby contributing to the growth of Nigeria's cassava value chain.

## REFERENCES

Adejumo, B.A. & Ola, F.A. (2010). Development of a combined gari post grinder sifting machine. *Journal of Agricultural Engineering and Technology*. 18(2): 77 – 86.

Adetunji, O.R., and A.H. Quadri. 2011. “Design and Fabrication of an Improved Cassava Grater.” *The Pacific Journal of Science and Technology* 12 (2): 120–29.

Adetunji, O R, D Ph, O U Dairo, D Ph, T Aina, B Engr, A S Osunlana, and B Engr. 2013. “Development of an Improved Garri Sifting Machine .” *The Pacific Journal of Science and Technology* 14 (2): 54–61.

Agbetoye, L.A.S. & Oyedele, A. (2007). Development of a dual powered gari sifter. *Journal of Agricultural Engineering and Technology*. 15: 32 – 39.

Bucklin, R.A., Thomson, S.A., Ross I.J., & Biggs R.H. (2003). Apparent dynamic coefficient of friction of grains. ASABE publishers. 36(6): 1915-1918.

Hall, A. S., A.R. Holowenko, and H.G. Laughlen. 1982. *Theory and Problem of Machine Design*. New York: Schaums outline series McGrew – Hill Book Company.

Hannah, J. & Stephen, R. (2004). Advanced theory and example in mechanics of machine shaft design. Edward Arnold Publisher Ltd, London; 5th Edition. Pp 313 – 316.

Khurmi, R.S, and J.K Gupta. 2005. *Machine Design*. New Delhi: S. Chand Publishing.

Kudabo, E.A, E.A Onipede, and O. A Adegbenro. 2012. “Design, Fabrication and Performance Evaluation of an Improved Cassava Mash Sifter.” *Journal of Agriculture and Veterinary Sciences* 4:53–64.

Mathew, J. M., R. C. Hoseney, and J. M. Faubion. 1999. “Effects of Corn Sample, Mill Type, and Particle Size on Corn Curl and Pet Food Extrudates.” *Cereal Chemistry* 76 (5): 621–24. https://doi.org/10.1094/CCHEM.1999.76.5.621.

Mohammed, Abubakar, Abdulkadir B. Hassan, Katsina C. Bala, Abdulkarim Nasir, Olawale J. Okegbile, and Dele S. Jimoh. 2015. “Fabrication and Performance Evaluation of a Pedal Driven Pulverizing and Sieving Machine for Dewatered Grated Cassava.” *American Journal of Engineering Research (AJER)* 4 (2): 146–52.

Oladipo, N O, L O Abiodun, N O Oladipo, and B L Bamidele. 2016. “Development of NCAM Reciprocating Cassava Mash Sifter .” *International Journal of Basic and Applied Sciences* 5 (1): 10–13.

Olaniran, J.A. & Adeleke, S.A. (2018). Development and performance evaluation of cassava mash sifting machine. *International Journal of Scientific and Engineering Research*. 9(7): 192 – 194.

 https://doi.org/10.59810/lejlace.v3i2.214

Sadhu, S.A. (2004). Machine design, classification of v – belt. New Delhi. Indian Romesh Chander Khanna Publisher. Pp 246 – 250.

Sanni, L. A., B. S. Ogunsina, and C. Oladigbo. 2008. “Development of a Rotary Pulverizer for Cassava Cake in Gari Production.” *Journal of Food Process Engineering* 31 (6): 783–97. https://doi.org/10.1111/j.1745-4530.2007.00189.x.

Tambari, Stephen, Dan-orawari G.I, Aziaka D.S, and Ayejah Victor. 2015. “Design Analysis of a Reciprocating Cassava Sieving Machine.” *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)* 12 (4): 07–15.

## APPENDIX

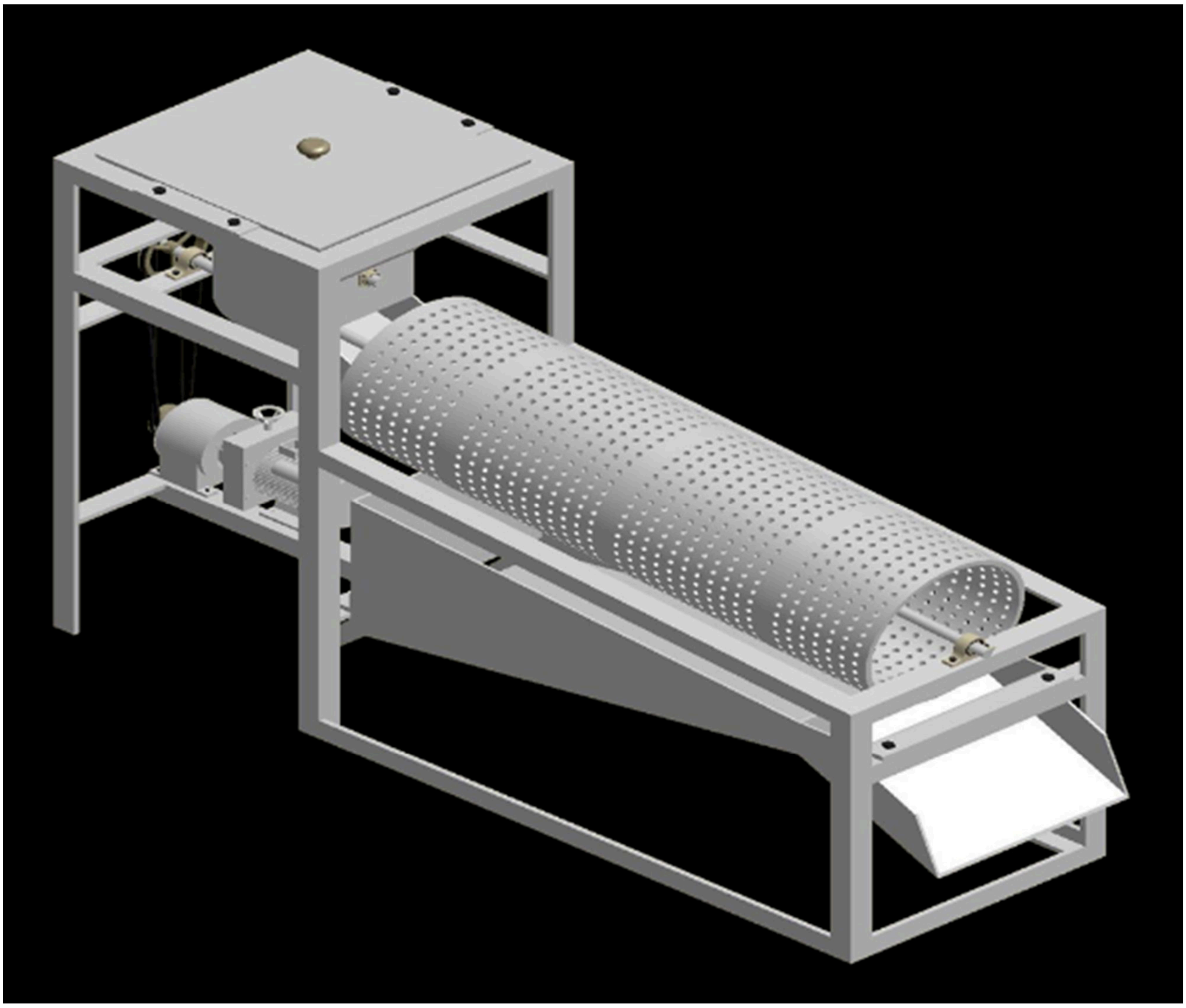

Figure 1. Isometric drawing of the proposed machine

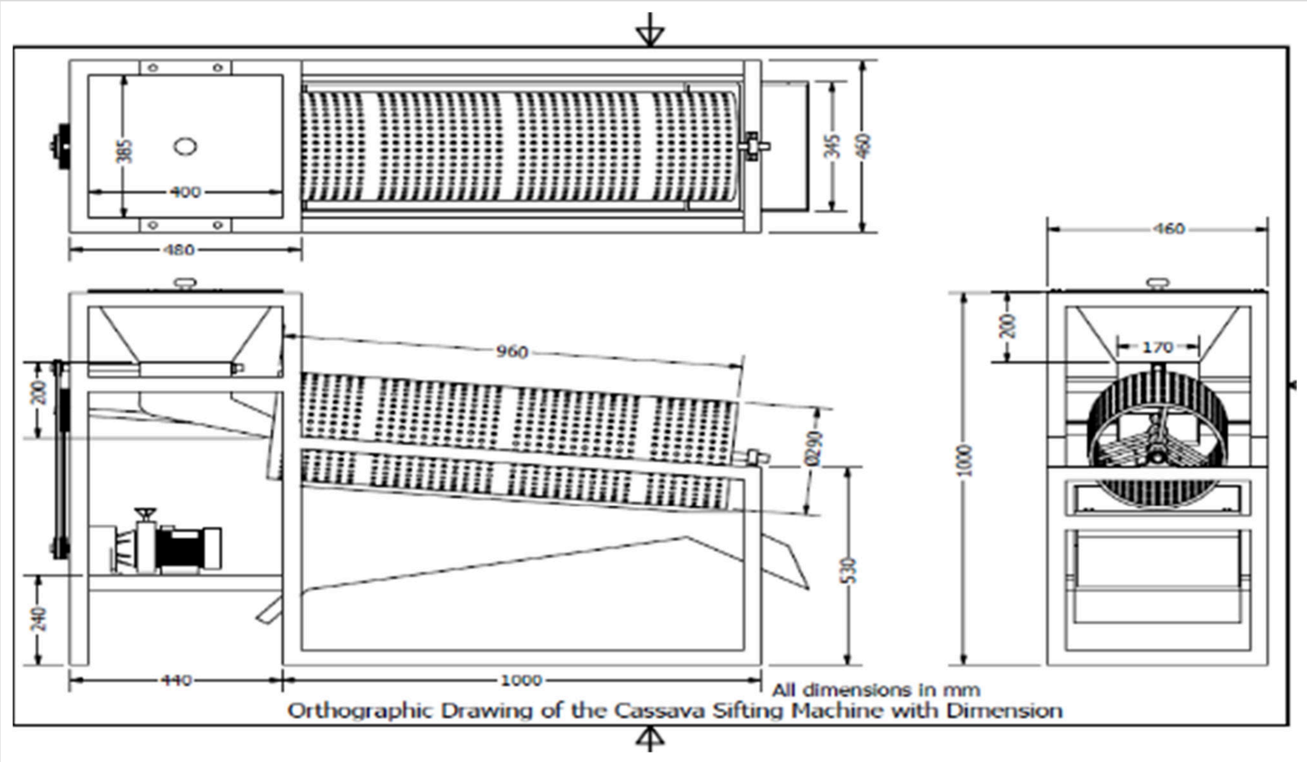


Figure 2. Orthographic drawing of the proposed machine

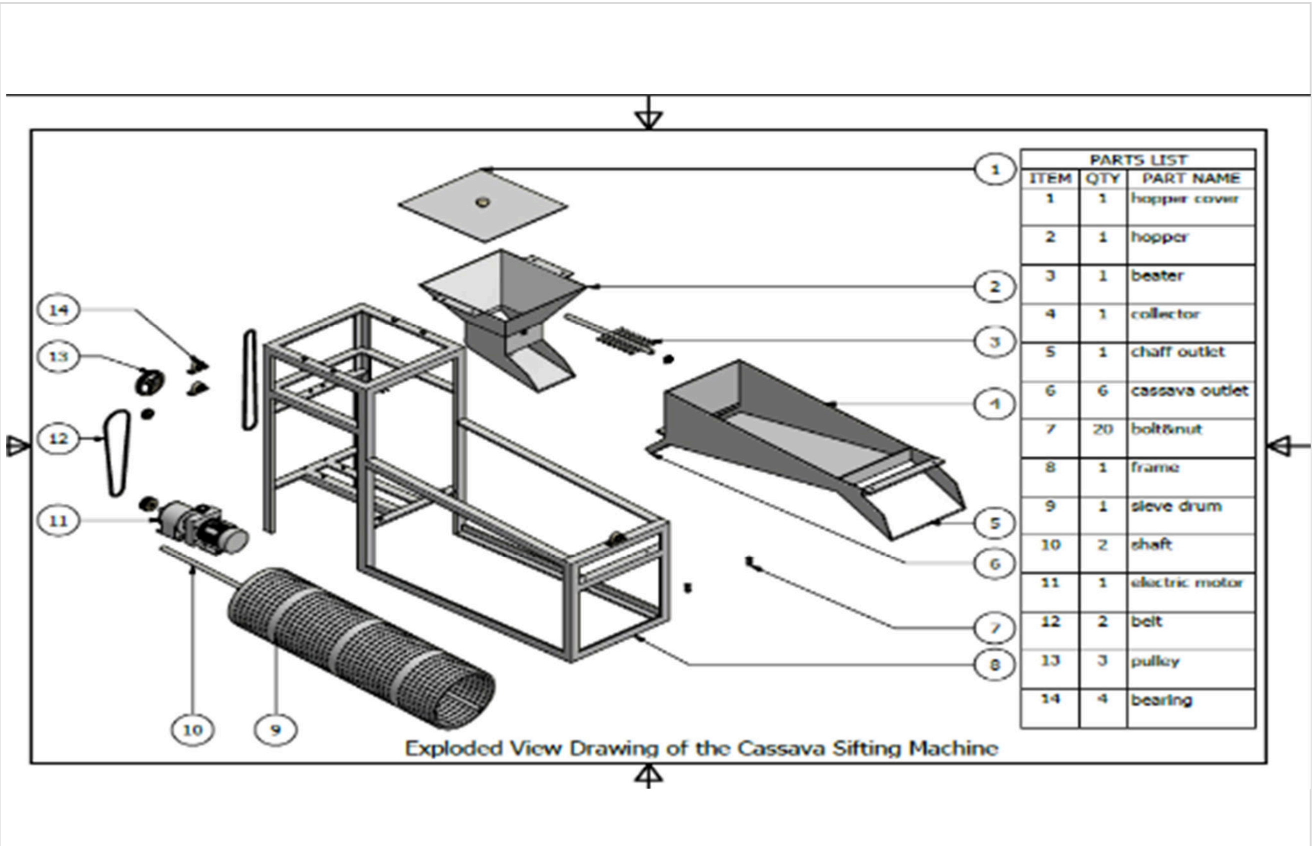


Figure 3. Exploded view drawing of the proposed machine


https://doi.org/10.59810/lejlace.v3i2.214