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***Full Length Research Paper***

# Development of NCAM Manually Operated Single Pole Dewatering Press

Oladipo N.O., Olotu F.B., Adamade C.A. and Agaja M.O
*National Centre for Agricultural Mechanization, Ilorin, Kwara State, Nigeria.*

**Corresponding Author: Oladipo, N.O*

*Abstract*
*The development of NCAM Manually Dewatering Press is done to minimize the level of drudgery, improve processing hygiene and ensure the wholesomeness of cassava mash. The cassava mash dewatering press used in this study is divided into the following major components; the handle, screw shaft, load support, pressure transfer plate, nut, and body frame. Investigation into the performance evaluation showed that the press has an average dewatering efficiency of 38.15% at a moisture content of 66.75% wet basis, for fermented cassava mash, and 37.68% for unfermented mash at 70.01% wet basis moisture content. The mean dewatering time for fermented cassava mash was 450mins while that of the unfermented mash was 500mins.*

*Key words: Dewatering Press, Manually, Single Pole, Development*

## Introduction

In Nigeria, following the pronouncement of a Presidential Initiative in 2002 promoting Cassava as a foreign exchange earner for the country and as well achieve self-sufficiency in its production has made Cassava to gain serious national prominence. This programme has increased the production, processing and utilization of cassava roots (Manihot species) in the country due to increasing economic value. Several products in high demand all over the world like starch, high quality cassava flour (HQCF), gari, tapioca; etc., can be produced from processing cassava roots. Odigboh (1985) reported that these products are obtained from the different units of operations after harvesting the roots which includes: peeling, washing, grating, chipping, dewatering, drying, and milling.

To minimize the level of drudgery, improve processing hygiene and ensure the wholesomeness of processed cassava products, serious attention is needed to develop appropriate processing equipment for the various unit operations in cassava processing. In answer to this call several efforts has been made in the mechanization of cassava processing, hence the development of processing machines such as cassava grater, chipper and dewatering press.

The moisture content of the cassava root is high, such that dewatering of the grated mash is a vital unit in any of its processing line. According to Kolawole *etal*., (2010), cassava contains 70% moisture content, which must be reduced to acceptable level for processing the mash to be convenient. Dewatering as a unit operation plays a major role in processing cassava roots into high quality cassava flour and gari, for it eases and as well hasten drying of the mash. This is essential where the rate of drying determines the quality of the flour or gari produced. Dewatering is also aimed at reducing cyanide level, improving processing convenience, storability and palatability.

Basically dewatering in cassava processing involves applying pressure on grated mash to remove moisture. The most simple and common traditional cassava mash dewatering process involves the use of logs of wood and heavy stones arrange and tied on bagged cassava mash to serve as load for pressing out the moisture. Most of these processes are simple but tedious and time consuming. This type of dewatering press was thus developed with the aim of reducing drudgery and dewatering time while retaining simplicity and expanding handling capacity.

## Materials and Methods

### *Machine principle of operation*

This dewatering press is operated manually to squeeze out moisture from bagged cassava mash. After loading bagged cassava mash into the press, flat woods plates are arranged on the top surface of the bags for even distribution of load. The screw shaft is then turned at the handle clockwise to lower the pressure transfer plate against the bags of mash. Turning is continued to enough pressure by the plate on the bags to make it drip its liquid content. Turning is later repeated intermittently until the bags stop dripping fluid. After dewatering to a required level, the shaft is turned anticlockwise raising the pressure transfer plate up to release the bags for offloading.

### *Design considerations*

In the design of this equipment, considerations included: low energy requirement and dewatering time, high dewatering capacity and efficiency, availability and cost of construction materials. Other considerations included the desire to use rigid load bearing members to avoid buckling during high pressure operation. High mechanical advantage and ergonomic requirement were also considered to minimise drudgery.

***Construction/Fabrication of Press***

The cassava mash dewatering press can be divided into the following major components; the handle, screw shaft, load support, pressure transfer plate, nut, and body frame.

**Handle:** The handle was fabricated was fabricated from a mild steel rod. It is 1200mm long and 21mm thick. At the ends, 500mm long and 12mm thick ms rods were attached at $45^0$ for easy push. The handle is attached to the screw shaft at its mid-point by a pin joint to allow for possible dismantling.

**Screw shaft:** This is made from the

**Load support:** This consists of two 120mm U-channels placed back to back, 110mm apart and welded to the top of the main frame. This is to carry the screw shaft nut and bear the resultant load from the pressure applied on the cassava mash by the screw shaft.

**Pressure transfer plate:** the pressure transfer plate is a 510mm diameter circular mild steel plate with 20mm thickness. It is connected to the lower end of the screw shaft by a flexible coupling. This plate is wide to enable even distribution of force transferred by the shaft on the loaded bags of mash.

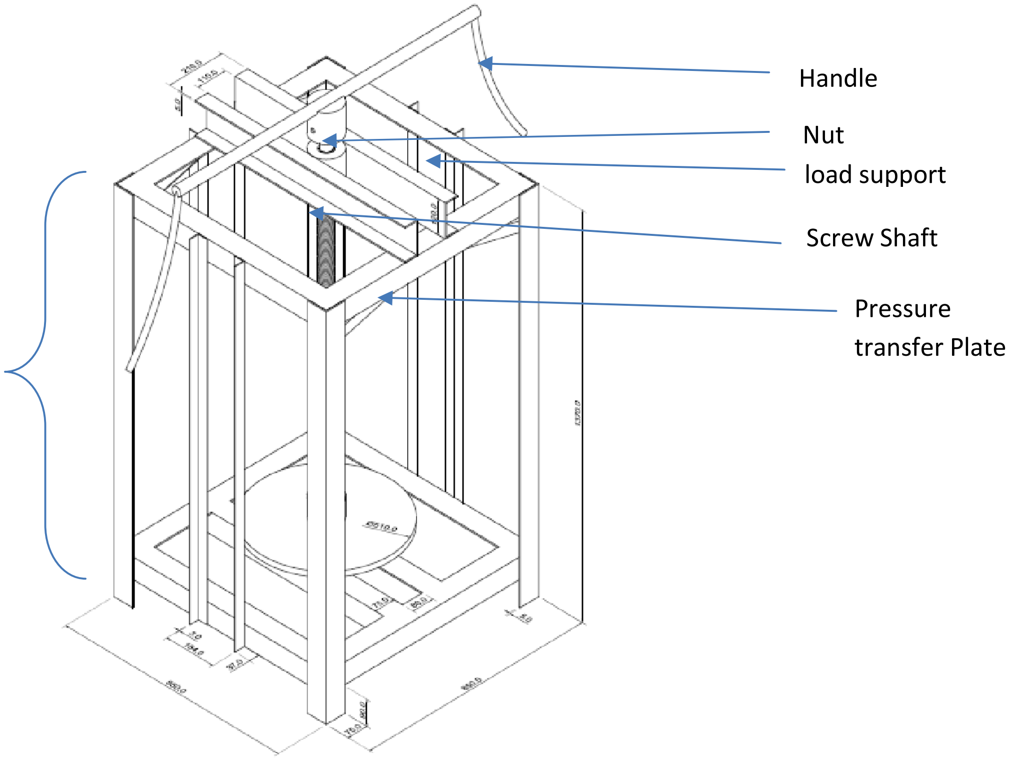


**Figure 1.** Isometric projection of single pole cassava mash dewatering press

**Nut:** this was made from a 110mm diameter and 120mm tall hardened steel shaft. A 40mm threaded hole was bored through it for screw shaft to drive through. This nut was welded in between the load support at their midpoint.

**Body frame:** the main frame was constructed with 75mm angle iron. This was welded together to form a 1370mm x 850mm rectangular box which can accommodate eight 60k bags of cassava mash. 30mm angle iron was used to brace the box, the base was covered with the 75mm angle iron for the bags of cassava mash to sit.

**Construction Process**

Fabrication was carried out at the fabrication workshop of the National centre for Agricultural Mechanization (NCAM), Ilorin.
The machines and equipment used for the fabrication of the dewatering press include power saw, lathe machine, drilling machine, gas and arc welding machine and hand grinding machine.

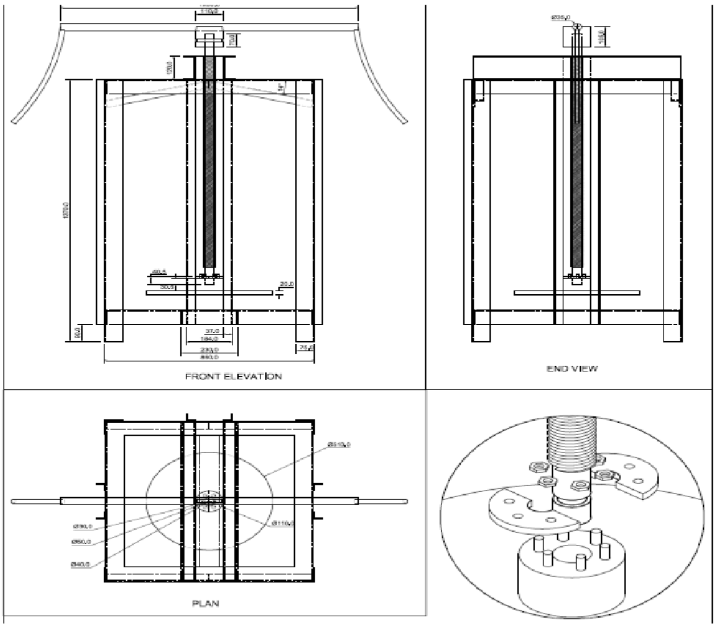


**Figure 2.** Orthographic projection of single pole

**Performance Test**

The preliminary test of the single pole dewatering press was carried out at the National Centre for Agricultural Mechanization, Ilorin. Eight bags each of fermented and unfermented 60kg grated cassava mash were loaded into the press in two separate batches. Moisture content of the mash was taken before and after dewatering.

Test were carried out to determine the following parameters;

(i) Dewatering rate ($D_R$) kg/s: this represents the quantity of moisture the machine expresses from the dewatered cassava mash per unit time. This is determined by the expression;

$$D_R = \frac{W_0 - W_1}{t}\ kg/s \qquad \text{.................................} (1)$$

Where,

$W_O$ = weight of cassava mash before dewatering in (kg)
$W_1$= weight of cassava mash after dewatering in (kg)
t= time taken to dewater in (s)

(ii) Moisture content (Mc) %: the percentage of moisture (in wet base) in the cassava mash before and after dewatering is its moisture and is expressed by the following equation,

$$Mc = \frac{Wb - Wa}{Wb}\ x\ 100\% \qquad \text{................................} (2)$$

Where,

$W_b$ = weight of the cassava mash sample before oven drying
$W_a$ = weight of the cassava mash sample after oven drying

(iii) Dewatering efficiency ($E_D$)% : this is the efficiency at which the press dewaters which is expressed as,

$$E_D = \frac{W_2}{W_3}\ x\ 100\% \qquad \text{...............................................} (3)$$

Where,

$W_2$ = weight of fluid expressed by the press given by,

$$W_2 = (W_0 - W_1) \qquad \text{...................................} (4)$$

$W_3$ = total weight of fluid in the mash given by,

$$W_3 = \frac{W_{C1}\ X\ W_C}{100} \qquad \text{... ... ... ... ... .....} (5)$$

(iv) Output capacity ($O_C$) kg/hr: this represents the quantity of cassava mash dewatered by the press per unit time, expressed by,

$$O_c = \frac{W_1}{\tau}\ kg\ hr^{-1} \quad \ldots\ldots\ldots\ldots (6)$$

Where,

$\tau$ = dewatering time in hrs

(v) Input capacity ($I_c$) kg $hr^{-1}$: this determines the quantity of cassava mash fed unto the dewatering press per unit time and is expressed as,

$$I_c = \frac{W_o}{T}\ kg\ hr^{-1} \quad \ldots\ldots\ldots\ldots (7)$$

## Results and Discussion

The result of the preliminary test carried out on the dewatering press with cassava mash from roots harvested during the raining season is presented in table 1. The result showed that the press has an average dewatering efficiency of 38.15% at a moisture content of 66.75% wet basis, for fermented cassava mash, and 37.68% for unfermented mash at 70.01% wet basis moisture content. The mean dewatering time for fermented cassava mash was 450mins while that of the unfermented mash was 500mins.

## Conclusion

- From this study, it has been observed that the two different types of mash; Fermented and Unfermented mash dewatered properly and the press is therefore recommended for adoption.
- The production of dewatering press of this nature will go a long way in economic empowerment and poverty alleviation which is one of the tools in boosting the availability of Gari for export market in developing countries.

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