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Full Length Research Paper

Effect of Filtrating Medium Resistance on Cassava Pulp Dewatering

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Cassava pulp dewatering by applying pressure on the grated pulp was carried out. Pulp particles were constrained while the liquid was free. The cassava pulp cake was compressed. Experimental equipment was designed to obtain the applied pressure from various devices and the final moisture content of resulting cake was compared. Hydraulic jack press reduced the moisture content of cake to the acceptable level for gari production at a pressure of 69000 N/m^2 and to a moisture content of 40%- 45%wet basis, Pulp particles capable of creating resistances within the filtering medium were identified.

Keywords: Dewatering, Specific resistance, Cassava pulp.

INTRODUCTION

Cassava is a major source of carbohydrates in human and animal diet, the tubers of cassava cannot be stored for longer period unless in processed form. Processing involves peeling, grating, dewatering, cake milling and sieving. These are ways of transforming the tuber into the two principal products, flour and *gari* for storage. Crops have optimum range of humidity and temperature for storage. Cassava contains about 70% moisture content, which must be reduced. The main requirement for obtaining the best product from cassava tuber depends on proper dewatering of the pulp. The reduction process includes fermentation and dewatering using available methods. Stones are sometimes placed on the cassava pulp sack. Alternatively the use of lorry jacked on wood platforms to press off the excess is possible (Igbeka *et al*., 1992).The Amerindians use ingenious press shaped like a long thin basket-weave tube called ´*tipiti*' for mash dewatering. Dewatering is mainly a manual operation under rural conditions. Other methods involve the use of log, sticks, Parallel board; Tree stumps, String and jacks. Hydraulic press at about 25 kg/cm^2 (Igbeka *et al*., 1992) was considered adequate within 15 minutes. Pressing can last up to 4 days with other older method. Study of centrifugation and direct pressure as means of dewatering was done for cassava starch production (Comparison study of centrifugation and direct pressure as dewatering means was used in studying the dewatering characteristics of alfalfa protein concentrate Klanarong *et al*., 1999).

In the dewatering of cassava pulp, the particles are constrained while the liquid are set free. The pressure applied varied in depth, time and in moisture content left in the cake, volume of material and the particles of material are some of the parameters identified by Kolawole *et al*.,(2007). The material moisture content,

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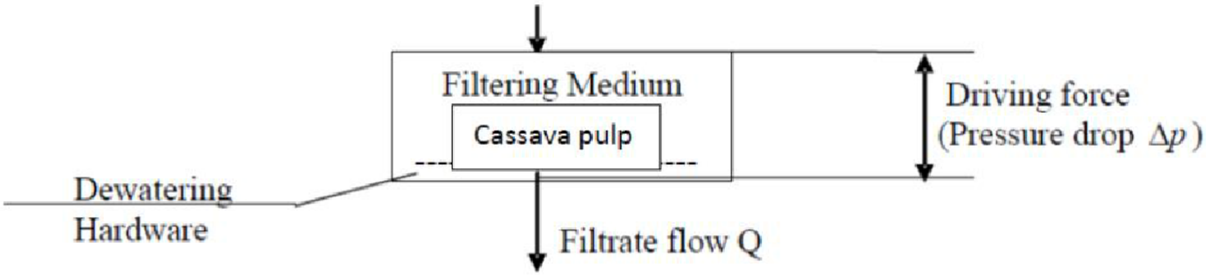

Figure 1. Schematic diagram of dewatering method

Table 1. Experimental Layout

CASSAVA VARIETY	MATURITY IN MONTH	CONTAINER	PRESSURE METHOD
TMS 4(2) 1425	9, 12 & 15	CYLINDRICAL, SQUARE SACK	BOLTS & NUT
TMS 4(2) 1425	9, 12 & 15	CYLINDRICAL, SQUARE SACK	WOODEN POLES
TMS 4(2) 1425	9, 12 & 15	CYLINDRICAL, SQUARE SACK	MOTOR JACK

the mass and the volume were parameters that can be determined easily.

To meet industrial expectations, there is need to carryout detailed engineering improvements of dewatering in cassava processing. Traditional procedures aimed at reducing cyanide, improving storability, providing convenience and palatability are becoming inadequate. Cassava pulp cake compression is require to completely eliminate moistures trapped in the void of the cake but resistant property of the cake normally opposed the reduction in volume as observed by Kolawole *et al.*, (2007). Further investigation of specific resistance (**α**) is needed. This is to provide a better understanding and what is expected changes during the dewatering with the pressure drop across the cake.

METHODOLOGY

Experimental equipment was designed and fabricated at workshop. Modified pressure gauge with tube was used to connect a compressible ball. The ball was small in size that can stay within a mash. The ball was filled with liquid such that pressure exerted on the ball can displace the liquid. The guage was used to prevent the liquid from escaping by so doing putting the liquid under pressure. The scale was made visible such that the pressure value can be read. Cassava pulp made by grating peeled and washed cassava tuber, were measured and kept in label sacks. The ball was kept in the samples of cassava pulp, such that applied pressure can be read directly from the gauge. TMS 4(2) 1425 variety of cassava was used for the experiment. Hydraulic system was use in applying the pressure as shown in figure 1.

The absolute pressure was obtained from a pressure gauge by adding atmospheric pressure to it Spring-element pressure gauge was used. The sealed end was connected to a pointer, the deflection of the pointer provide the pressure reading. Pressure on the walls of the box was considered. Pressure on one side is the same as the pressure on other side (Kolawole, *et al.*, 2011)

P_{max} is the maximum pressure expected on the samples, Pressure at the centroid the area

$$\alpha = f(\Delta P) \quad (1)$$

Then Pressure on the constant element dA

$$p = p_c + \rho h z \quad (2)$$

Where z is the ordinate of Area dA

Pressure was excited on the equipment; same readings were obtained for the repeated measurement readings. The tool was then used to carry out dewatering experiment.

Dewatering of cassava pulp with bolts & nut, motor jack and wooden pole was carried out. The procedure involves each of cassava-pulp samples dewatered carefully, ten treatments of each was selected. The observed pressure reading from the attached pressure gauge was recorded. The measurement of time was done using a stopwatch. The starting time was noted with the volume of expressed liquid. The pressure was kept constraint at the pick, for every 30 seconds as the liquid gradually drops in flow rate the change in volume was noted. The cumulative filtrate volume and time presented were recorded in data sheet. The filtrates were allowed to settle and filtered, the solid content were weighed and recorded. The moisture content of the cassava pulp

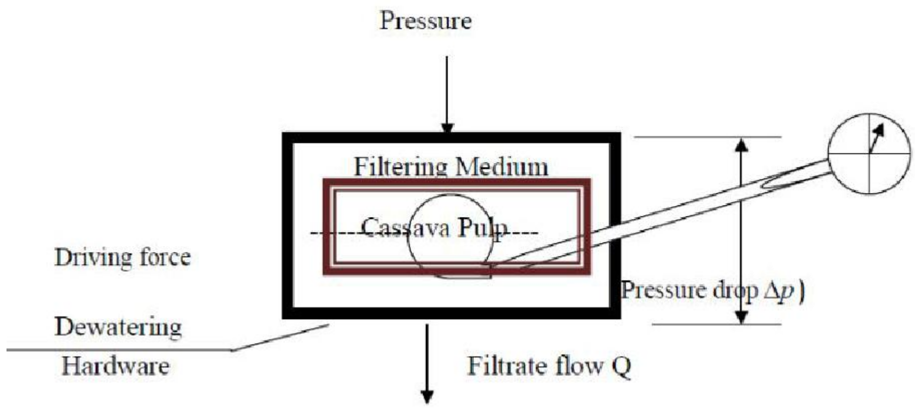

Figure 2. Schematic diagram of dewatering experiment

Table 2. Solids causing resistant during pulp dewatering

PRESSURE METHOD	Average solid collected from Cassava Juice
Wooden pole	12g
Motor Jack	26g
Bolt and Nut	17g

samples was determined before and after the experiments this was determined by drying the samples in an oven at 100^{o}C until no further change in weight occurred. This took 70-72hrs in a Try-temp Hot pack oven and weighing took place daily.

The measurement of time was done using a stopwatch. The starting time noted with the volume of expressed liquid, The pressure was kept constraint at the pick, for every 30 seconds as the liquid gradually drops in flow rate the change in volume is always noted. The cumulative filtrate volume and time presented were recorded. The moisture content of the cassava mash samples was noted before and after the experiments. The moisture content of samples was obtained by drying the samples in an oven at 100^{o}C until no further change in weight occurred. This took three days of 70-72hrs in a Try-temp Hot pack oven and weighing took place daily. Pulp resistance was noted as internal resistance developed as opposed to applied pressure, only determined with calculation from the data obtained when a constant pressure operation was carried out on the samples. Dewatering tanks made into shapes that the filtration Area was calculated with ease, the base area of containers in use when pressure was applied to the mash during the experiment.

RESULT

The volume of filtrate obtained from the samples show that the 9 month old variety contains more juice than the 12 and 15 months old variety at the start of the experiment. The 12 months old had more juice mixed with starch at the end. This may be due to maturity at peak for the variety. The 15 months old compressed more than the 9 and 12. Mixture of the 9,12 and 15 months as shown in figure 3, prove that bolt and nut can provide drier cake more than the traditional method of wooden pole this can be due to fibre formation within the cassava.

The investigations revealed that increase in pressure had an effect in lowering the moisture content of cassava pulp. Pressure of 7,000 to 8,000 N/mm^2 reduced the moisture content to 45-50% moisture content wet basis, a level suitable for *gari* and flour production, Cooking and drying could take place simultaneously during frying with the left over moisture, using bolt/Nut and jack the containers met the same condition set for *gari*. Higher pressure above 10,000N/mm^2 produce bone dry mash that can not be suitable for *gari* production but may be better for cassava flour.

DISCUSSION

During dewatering the reduction of the volume of mash was more than the volume of the liquid, this may be due to the compaction and creep that occurs during the process. Void places containing air must have been displaced. The best age of cassava for gari production may be between 9 and 12 month old. The 9 months old contains more fluid but it has more resistant than the 15months old, this could be that it contains more fibres than starch as shown in figure 4. The solid content of the

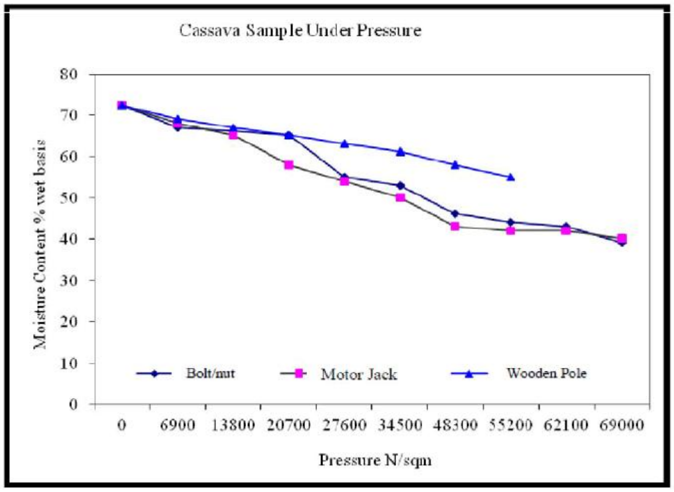

Figure 3. Mixture of sample under Pressure

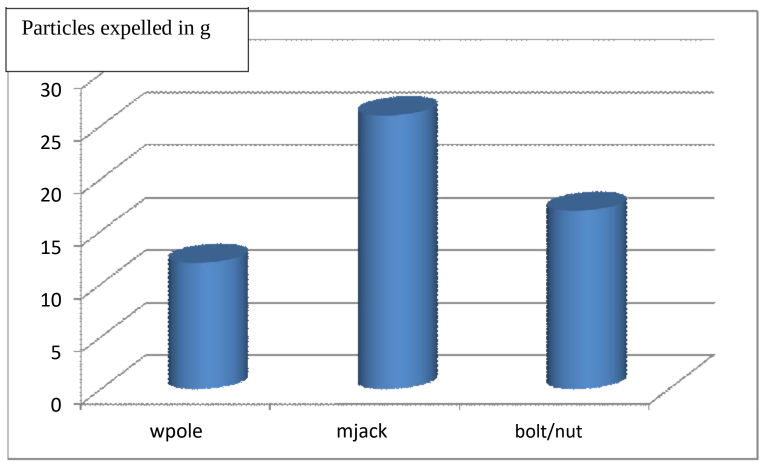

Figure 4. Quantity of particles expelled per 10 kg of pulp.

expressed juice could be important for the production of industrial starch from cassava. It was observed that the solid content varied during dewatering within the range of 7% to13% average of 8.3% the density of juice was between 0.9 to 1.2 g/cm^3

The cassava juice was found to contain small particle that travels with the juice, cake starts to build up on the surface of the filtering sacks and a greater proportion of the available pressure drop was taken up by the cake itself. This resulted in an effective increase in the mash resistance thus leading to a gradual drop in the cassava fluid flow resulting in cake with uneven moisture. The fluid flow slows down with time. Thus, the overall resistance to flow of filtrate is equal to the sum of the cake resistance and the filtering medium resistant. This is important only during the early stages of filtration.

In the experiment, the medium resistance was not constant because of some penetration and blocking of the filtering medium as a result of particles impinging on the sack, high initial flow rates through a clean sack compared with the flow rate towards the experiment. This was avoided in the experiment in order to prevent the penetration of solids if clean with large screen holes was made used (Filters). Prevention of contamination from the filtrate was not possible as the hydraulic jack forces out more through the filter opening, more than required (Table 2) and this do not allow even deposition of the cake within the sacks.

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CONCLUSION

The results obtained in figure 2 show that not much pressure can be sustained by wooden poles method, as more time was spent to get to the required moisture content. The bolt/nuts and the jack's methods were very efficient. The motor jack method of dewatering gave clear efficiency with the 12 months old sample as shown in graph but nothing was noticed between the bolts/nuts method and hydraulic jack methods when used on 9 and15 month old samples. Hydraulic Jack press could reduce the particles that can form resistance to prevent filtrate movement, it is recommended for used to achieve greater efficiency in gari production, particles expelled is as shown in figure 4.

REFERENCES

Ajibola OO (1987). Mechanical Dewatering of Cassava Mash; Transactions of ASAE 1987, 30(2):539-542.

Diop A (1998). Storage and Processing of Roots and Tubers in Tropics; Food and Agricultural Organisation of UN Agro-Industries and Post-Harvest Management Service Agro Supports System Division,

Igbeka JC, Jory M, Griffon D (1992). Selective Mechanization for Cassava Processing. Agricultural Mechanization in Asia, Africa and Latin America.Vol. 23(1): 45-50.

Klanarong S, Sittichoke W, Rungsima C, Sunee C, Kukakoon P, Christopher GO (1999). An Improved Dewatering Performance in Cassava Starch Process by A Pressure Filter, Kasetsart Agricultural and Agro-Industrial Product Improvement, Kasetsart, University Thailand http://cstru.00go.com/1999/1999_03.htm

Kolawole OP, Agbetoye LAS, Ogunlowo AS (2011)Evaluation of Cassava Mash Dewatering Methods Journal of Bioinformatics and Sequence Analysis Vol. 3(2): 23-30, http://www.academicjournals.org/JBSA

Kolawole OP, Agbetoye LAS, Ogunlowo AS (2007). Cassava Mash Dewatering Parameters International Journal of Food Engineering:Vol.3:Iss.1,Article4.10.2202/1556-3758.1088 www.bepress.com/ijfe/vol3/iss1/art4

Sperry V (1979). Mobile Hydraulic Manual, M-2990A, 2nd Edition Sperry Corporation, Troy Michigan 48084, p 4-20, 1979.

Straub RJ, Bruhn HD (1978). Mechanical Dewatering of Alfalfa Concentrate. Transactions of ASAE 21(3): 414-421.