EFFECT OF DRYING METHODS AND PRODUCTION PROCESS ON THE QUALITY PARAMETERS OF UNFERMENTED CASSAVA FLOUR

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ABSTRACT

High Quality Unfermented Cassava Flour is a product of cassava root that is acceptable with high market and nutritional value. Two different drying methods were tested to determine its quality requirements and the effect of the drying methods used. Investigations into the effects of drying methods and production process on the quality parameters of Unfermented Cassava Flour revealed that there is a significant difference in the flour composition by percent dry weight. The quality parameters investigated were Moisture Content, Protein Content, Ash Content, Fat Content, Carbohydrate Content and Fibre Content. Results obtained showed that flour obtained using NCAM kerosene fired batch dryer (Sample A) has a mean Moisture Content 10.03%, Protein Content 0.14%, Ash Content 1.08%, Fat Content 0.6%, Fibre Content 1.69%, Carbohydrate Content 79.85% and HCN 14.03 mg/kg while cassava flour obtained using sun drying (Sample B) has a mean moisture Content 11.64%, Protein Content 0.13%, Ash Content 4.47%, Fat Content 2.06%, Fibre Content 3.85%, Carbohydrate Content 80.33% and HCN 14.62 mg/kg. The result of product from NCAM kerosene fired batch dryer conforms to the Nigerian Industrial Standard. This indicates that NCAM kerosene fired dryer dries crop faster and performs better when compared to the sun drying method.

KEYWORDS: Cassava flour, drying, unfermented, ash content, fat content, protein content.

1. INTRODUCTION

Cassava (Manhot species) is a crop which tolerates drought and low soil fertility and is primarily grown by small scale farmers in area with marginal soils or unfavourable climate. It has the ability to withstand poor environmental condition (Nweke et al 2000). It has now become a major economic activity in Nigeria due to the encouragement given by the government through Root and Tuber expansion programme. According to Ihekoronye and Ngoody, (1983), Cassava root constitute the following: Starch 20 – 30 %; Protein 2 – 3 %; Water 75 – 80 %; Fat content 0.1 % and Ash content 1 – 1.5%.

The processing of cassava roots into cassava flour involves the following steps: washing, peeling, washing, grating, pressing, drying, milling and sieving for unfermented cassava flour. This process does not act on the cyanogenic potential (Hahn, 1989) and is suitable for the sweet cassava varieties. On the average cassava flour contains as stated by Bamiyo (2003):

Moisture Content	10%
Protein	1.5%
Carbohydrate	86%
Ash	0.9%
Fibre	2.0%
Particle size	350 – 350 micro

Traditionally, cassava flour known as lafun is a product of dried fermented or unfermented cassava chips or mash which is then milled to desired particle sizes. There are two basic process lines required for the production of unfermented cassava flour: chips and grated mash. The resultant flour in this process is known to be white in appearance (Bamiyo, 2003). Cassava flour is often made at home from unfermented cassava chips, so chips are an important intermediate product making up a major proportion of marketed cassava in Africa (Hahn 1989). Drying is necessary to improve the quality, market value and to preserve agricultural products from spoilage during storage. The elimination of total cyanide from cassava chips are done by drying with heated air. Cassava roots are dried by sun drying for 2 to 5 days depending on the weather and by using artificial drying method (Batch dryer) for some hours.

However, cassava has its problem. It is full of carbohydrate and very little protein. On digestion, carcinogenic glycosides present in the root are broken down and cyanide can be released into the body system. These can be removed by washing the cassava in clean water and dry. It is estimated that 40% of the cassava production in Nigeria is lost due to lack of processing capacity and market outlet (Nweke et al 1998). Therefore, commercial production of unfermented cassava flour will bring about rapid socio-economic transformation, which will raise the standard of living of many rural dwellers, create job opportunities enhances its marketability and also assist in the production of animal feeds for livestock (through pellets).

This paper therefore examines the effect of two drying methods on the quality of cassava flour obtained through chips. The objectives of this study are to: determine the effect of each of the drying methods on the quality of unfermented cassava flour; compare the quality parameters of flour obtained from the two drying methods and determine the most appropriate drying method that will produce high quality unfermented cassava flour.

2. MATERIALS AND METHODS

2.1 Description of the Dryer

The batch dryer of dimension 2501 mm by 1165 mm by 810 mm was designed and fabricated at NCAM. It consists of a blower unit, belt pulley transmission system, burner unit, 4.5 KW diesel engine, the plenum and drying tray of dimension 2 mm diameter. The dryer was constructed with 1.5 mm galvanized sheet and 50 mm by 50 mm angle iron.

2.2 Experimental Procedure

The research was conducted at the National Centre for Agricultural Mechanization (NCAM) Ilorin. Fresh Sweet Cassava roots (Manihot Palmata) were purchased from the market, sorted, peeled and washed with clean water and allowed to drain. The roots were then converted into chips using NCAM Chipping machine powered by a 5Hp prime mover. The mash was dewatered with a screw press designed and fabricated in NCAM. Drying operations were done using NCAM designed kerosene fired batch dryer and sun drying respectively. Samples were milled using NCAM designed milling machine operated by a 7hp prime mover. The flowchart for the process is shown in Fig 1.

The analysis was carried out using AOAC (2000) method at the University of Ilorin Chemistry Laboratory. The factors investigated include: moisture content, ash content, protein content, fibre content, fat content and carbohydrate content.

i. **Moisture content:** This was determined using oven drying method
ii. **Protein content:** Determined using the Micro Kjeldah method
iii. **Ash content:** Calculated using $\frac{100}{W} \times xy$

Where x = weight of crucible + ash; y = weight of crucible; w = weight of sample (g) before ashing

iv. **Fat content:** Calculated using $\frac{A - B}{C} \times 100$

Where A = Initial weight of sample + thimble; B = Final weight of sample + thimble; C = Initial weight of sample

v. **Fibre Content:** Calculated using $\frac{C_1 - C_2}{W} X\ 100$

Where $C_1 - C_2$ is weight of fibre; W is weight of sample

vi. **Carbohydrate Content:** The total percentage carbohydrate content was determined by difference method. This involves adding the total values of protein, fat, ash, fibre and moisture content and subtracting it from 100.

vii. **Cyanide Content:** The Cyanogenic glycosides (HCN) content was determined by the Argenimetric titration method.

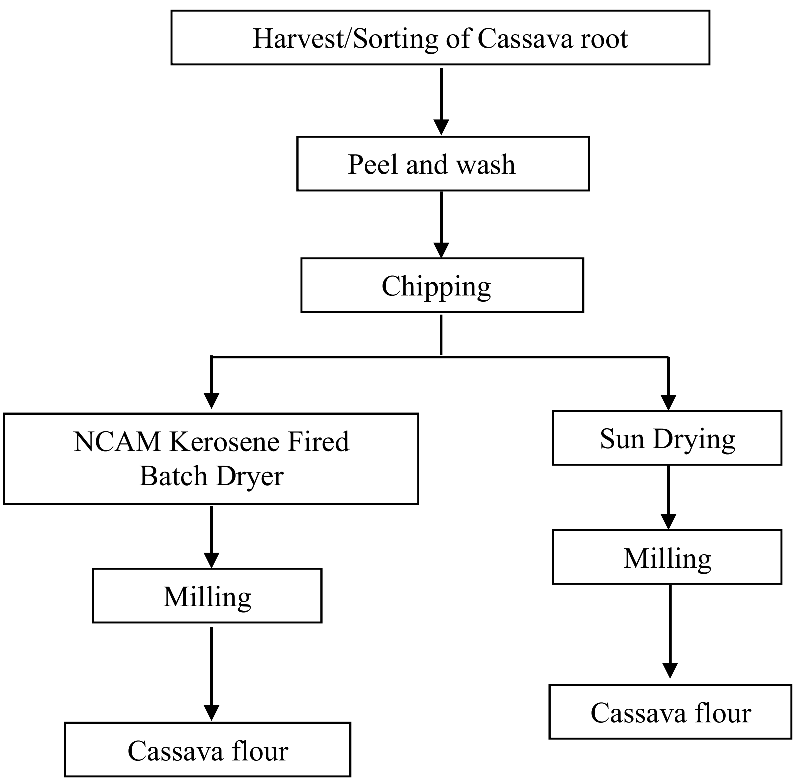

Fig. 1. Process flowchart for the production of the cassava flour

3. RESULTS AND DISCUSSION

3.1 Proximate Composition/Cyanide Content of the Flour

Table 1 shows the experimental values for cassava flour processed by using NCAM Kerosene Fired Batch Dryer, Table 2 shows the experimental values for cassava flour processed by using Sun-drying method and Table 3 indicates the mean values for both drying methods. Analysis with student T test revealed that there is significant difference at 5% confidence level of the products from each of the drying method.

3.2 Effect of Moisture Content on the Drying Methods

Results obtained from using NCAM Kerosene fired dryer (Sample A) showed a Moisture Content of 10.03% which compares favourably with the specification by the Nigerian industrial standard (NIS, 2004). Ogazi and Jones (1990) also reported that 10% moisture content in flour is ideal for good keeping quality while Moisture Content for Sample B showed 11.64% which is above recommended level. The independent T-test group Statistics which was carried out to compare the means of the two different variables of interest; NCAM batch drying and Sun drying method, with assumption of equal variance showed that the mean values of moisture content from the two drying methods are significantly different from each other at 5% level of significant. Furthermore, the descriptive statistics of the two methods and standard deviation of the moisture content from the two factors showed that the mean value of 11.6360 and the standard deviation of 0.01517 for sun drying tend to behave differently to mean value (10.0140) and standard deviation (0.02702) of NCAM batch drying method.

3.3 Effect of Fibre Content on the Drying Methods

The crude fibre for Sample A was 1.69% which is in line with Sanni *et al*, (2003). The maximum value stated by NIS (2004) prescribed 2.0% as the maximum. For Sample B, the crude fibre recorded 1.86% which is also within the range. The independent T-test group Statistics was carried out to compare the means of the two different variables of interest, NCAM batch drying and Sun drying method, with assumption of equal variance. From the result, mean value of Fibre content from the two drying methods were significantly different from each other at 5% level of significant. Also the mean value (1.8580) and the standard deviation (0.00837) of Fibre content from sun drying tend to behave differently to mean value (1.6860) and standard deviation (0.00548) of NCAM batch drying method.

Table 1: Experimental Value of Analysis on Product from Batch Drying

Rarameters	1	2	3	4	5
Ash Content (%)	0.89	0.90	0.89	0.75	0.80
Moisture Content (%)	10.03	10.02	10.04	9.97	10.01
Protein Content (%)	0.14	0.14	0.14	0.13	0.14
Fat Content (%)	1.08	1.10	1.09	1.10	1.08
Carbohydrate Content (%)	79.85	80.00	79.90	79.99	80.01
Fibre Content (%)	1.69	1.68	1.69	1.69	1.68
HCN mg/kg	14.02	14.01	14.01	14.00	14.02

Table 2: Experimental Value of Analysis on Product from Sun Drying

Rarameters	1	2	3	4	5
Ash Content (%)	1.85	1.87	1.86	1.87	1.90
Moisture Content (%)	11.62	11.65	11.64	11.62	11.65
Protein Content (%)	0.128	0.25	0.13	0.121	0.127
Fat Content (%)	1.05	1.06	1.05	1.08	1.06
Carbohydrate Content (%)	80.33	80.36	80.37	79.9	80.20
Fibre Content (%)	1.87	1.85	1.86	1.86	1.85
HCN mg/kg	14.60	14.62	14.63	14.60	14.59

Table 3

Rarameters	NCAM – Fried Dryer	Sun-drying
Ash Content (%)	1.08	1.05
Moisture Content (%)	10.03	11.64
Protein Content (%)	0.14	0.13
Fat Content (%)	1.6	1.05
Carbohydrate Content (%)	79.85	80.33
Fibre Content (%)	1.69	1.86
HCN mg/kg	14.03	14.61

3.4 Effect of Fat Content on the Drying Methods

The Fat content for sample A was 0.6% which if compared with Sanni et al (2003) had a maximum value of 0.6% while for Sample B was higher than the maximum value stated. The Ash Content obtained for

Sample A was 1.08% and Sample B was 1.05 %. Apea *et a*l, (2007) gave an ash content of 0.70% - 2.21%. Despite the differences the products contain some mineral content and thus can be used for animal feed production. The independent T-test group Statistics was carried out to compare the means of the two different variables of interest, NCAM batch drying and Sun drying method, with assumption of equal variance assumed. The mean values of ash content from the two drying methods are significantly different from each other at 5% level of significant. The statistics of the two methods shows mean and standard deviation of the ash content from the two factors. At the end, the mean value 1.8700 and the standard deviation 0 .01871 of ash content from sun drying tend to behave differently to mean value 0.8460 and standard deviation 0.06731 of NCAM batch drying method.

3.5 Effect of Protein Content on the Drying Methods

The protein content showed 0.14% for Sample A while Sample B was 0.13% which can be as a result of the variety of cassava used. The independent T-test group statistics was carried out to compare the means of the two different variables of interest (NCAM batch drying and Sun drying method). From the test, the mean value of protein content from the two drying methods was significantly different from each other at 5% level of significant. Furthermore, the display shows mean and standard deviation of the protein content from the two factors. The implication of this is that the mean value (0.1520) and the standard deviation (0.05495) of protein content from sun drying tend to behave differently to mean value (0.1380) and standard deviation (0.00447) of NCAM batch drying method.

3.6 Effect of Carbohydrate Content on the Drying Methods

Carbohydrate Content of approximately 80% was obtained for Sample A. This is in line with NIS 2004, which shows that it is full of carbohydrate as a source of energy. The HCN content of 14.03 mg/kg was obtained for sample A. This is within the range specified by Standard Organization of Nigeria for Edible Cassava Flour with maximum of 20 mg/kg. The independent T-test group statistics was carried out to compare the means of the two different variables of interest, NCAM batch drying and Sun drying method, with assumption of equal variance, the analysis carried out showed that the mean value of carbohydrate content from the two drying methods are significantly different from each other at 5% level of significant. The result shows mean and standard deviation of the carbohydrate content from the two factors. This means that the mean value (80.2320) and the standard deviation (0.19766) of carbohydrate content from sun drying tend to behave differently to mean value (79.9500) and standard deviation (0.07106) of NCAM batch drying method.

3.7 Production Process

Drying process which is a conventional production process in chip production was reduced as related to the duration of processing using NCAM kerosene fired batch dryer. Using NCAM batch dryer, chips were dried for approximately 8 hours of processing time while in the case of sun-drying a maximum of 3 days was used. The flour processed using the NCAM dryer has composition that conform with Nigerian Industrial Standard.

4. CONCLUSIONS

Results from the composition of the cassava flour produced using the two drying methods indicated that:

i) The drying methods had effect on the proximate composition.
ii) Due to the reduction on drying time and energy for the process, drying of cassava chips with NCAM kerosene fire batch dryer is faster and most satisfactory, than sun drying.
iii) Cassava flour produced from both drying methods is recommended for animal feeds because of the high fibre and carbohydrate level.

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