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Performance evaluation of cassava drying technologies: a case study from Uganda

Abstract

Dried cassava chips have varied applications by end users that include breweries, confectionaries, starch and flour for food. In Uganda, over 80% of Cassava farmers dry their products by open sun drying and direct passive solar dryers. However, these two drying practices produce varying quality of dried products which may not be good all for the various end users. The quality of dried products depends on factors like cassava chip size, drying technology, temperature, air flow and relative humidity. The objective of this study was to assess the performance of cassava sun drying on a raised platform and drying in a direct passive solar dryer. The two drying technologies were assessed basing on drying rate and product quality of cassava using a randomized complete block design experiment. The measurements considered for drying rate and quality assessment were drying time, moisture content, pH, peak viscosity, starch content and microbial contamination in terms of Total plate count (TPC), Total coliforms (TC) and Yeast and moulds (YM). Results showed that samples dried on the raised platform had higher drying rates than those dried in solar dryer. Additionally, Cassava samples dried on the raised platform showed superior quality in terms of microbial contamination compared to samples dried in the solar dryer.

Keywords: Cassava drying, solar dryer, raised drying platform, bananas, production

Volume 8 Issue 2 - 2020

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Received: April 30, 2020 | **Published:** May 18, 2020

Introduction

Cassava is one of the major crops produced in Uganda, together with plantain, maize, sweet potatoes, and sugar cane.[1] It is the second most important staple crop in Uganda after bananas, with production being dominated by smallholders.[2] According to UBOS (2017),[3] the Eastern region reported the highest production of cassava followed by the northern region, Western region and Central region. The crop is grown for food and income and is traded in different forms as cassava flour (50%), dried cassava chips (45%) and raw cassava (5%) and about 200,000 MT of cassava flour are consumed per annum in Uganda, with most of it being traded in traditional informal markets and negligible quantities featuring in supermarkets,[2] the major challenges at processing level being high cost of processing, poor quality and erratic supply of cassava. The quality of dried cassava chips depends on factors like Cassava chip size, drying technology, final moisture content, microbial contamination, colour and drying time. Drying is a unit operation aimed at removing nearly all water present in a food stuff.[4] The commonly used methods of drying cassava in Uganda include use of solar dryers both active and passive, open sun drying on bare ground, raised platforms, road sides, roof tops, and tarpaulins. However, the current practices for cassava drying, mainly sun drying though economical,[5] have many disadvantages such as spoilt products due to rain, wind, dust, insect infestation, animal attack and fungi. Thus in Uganda, the crop has 19% postharvest losses with 60% aflatoxin prevalence.[6]

Materials and methods

Materials

The materials and equipment used for the investigation are the raised drying platform and direct passive solar dryer used for all the drying experiments, freshly harvested cassava tubers of the NASE 14 variety obtained from the farmer's field. All other experiments were carried out in the laboratories of the school Food Technology, Nutrition and Bio-Engineering, Makerere University.

Methods

Sample preparation: Fresh roots were harvested, peeled, washed using portable water and then sliced using hand knives. Four cassava chip sizes as illustrated in Figure 1 were studied; size 1 was 9 cm arch length obtained after first slicing of an average tuber which was found to be 6 cm diameter, size 2 was a whole tuber of 3 cm thick diameter, size 3 was 5 cm arch length obtained after second slicing and size 4 was 2 cm arch length obtained after third slicing of the average tuber.

Experimental set up: Four cassava chip sizes of NASE 14 variety, which is mostly grown in Uganda, were monitored for drying using open sun drying on a raised platform and direct passive solar dryer. A Randomised Complete Block Design experiment was set up at the farmer's field and the four cassava chip sizes were subsequently subjected to the two-mentioned drying technologies in 3 replicates. The chip sizes were randomly distributed among units of 0.75m^2 on the drying beds and uniformly spread. Two experimental runs were conducted for each treatment.

For both drying technologies; before, and after drying; moisture content and microbial load that included Total plate count (TPC), Total coliforms (TC), Yeast and Moulds (YM) were measured. After drying, pH, peak viscosity, pasting temperature, and starch content of flour produced from the two drying technologies were measured. Temperature and humidity were also measured since they have an effect on the drying rate and quality of the products. During drying, moisture content was monitored every day by weight loss method dryer. The raised platform being open allowed free movement of air around all surfaces of the cassava chips thus allowing uniform drying and less mould growth. Inadequate performance of the dryer was attributed to the moist bottom surfaces of the cassava that provided suitable environment for mould growth. While cassava chip size 2 cm arc length dries in the shortest time of 4 days under both drying technologies, it is associated to large drying area occupation, injuries and much time consumption during slicing. Therefore, cassava chip size of 5cm arc length is recommended since its drying time was not significantly longer than that for 2cm arc length, occupies less drying area and can easily be achieved by slicing using hand knives.

Funding

Our sincere appreciations go to the Swedish International Development Cooperation Agency (SIDA) for financial support of this research.

Acknowledgments

None.

Conflicts of interest

The authors declare that there was no conflict of interest.

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