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Comparison of cassava and potato drying using solar dryer and sun drying

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Abstract
One of the major problems farmers face is preservation of their farm produce. A lot of cereal, vegetable and fruits waste in the farm before reaching the market or consumers due to inadequate preservation method. Drying of agricultural produce in the sun is one of the traditional ways of preservation of the farm produce. Sun drying of crops has a lot of limitation due to unsteady solar radiation. This work compared drying using solar dryer and sun drying using cassava and potato with weight of 10 Kg each. The weight reduction using the two methods was due to loss of moisture content. It was observed in the experiment that drying of farm produce using solar dryer is more efficient than sun drying. The minimum weight of cassava and potato after drying for six days using solar dryer were 5.5Kg and 5.1Kg respectively. Using sun drying the weight of the two was found to be 6.5Kg and 5.9 Kg. The minimum atmospheric temperature recorded during the experiment was 26 °C.

Keywords: Solar Drying, Sun Drying, Preservation, crops and Atmospheric Temperature.

1. Introduction

Exposure of Agricultural products to wind and sun is the preservation method practiced over the centuries throughout the world [1]. Drying, particularly of crops is an important human activity and globally the use of dried products is widespread [2]. Sun drying is still the most common method used to preserve agricultural products in most tropical and subtropical countries [3]. Cereals, legumes and green forages are dried in the field immediately after harvesting. Fruits, vegetable, species and marine products as well as threshed grains are spread out in the thin layers on the ground or trays, respectively [4]. Other methods include hanging the crop underneath a shelter on a tree or racks in the field. During sun drying heat is transfer by convection from the surrounding air and by absorption of direct or diffuse radiation on the surface of the crop. The converted heat is partly conducted to the interior increasing the temperature of the crop and partly used for effecting migration of water and vapour from the interior to the surface. The remaining amount of energy is used for evaporation of the water at the surface or lost to ambient via convection or radiation. The evaporated water has to be removed from the surrounding of the crop by natural convection supported by wind forces [5]. Under ambient conditions, these processes continue until the vapour pressure of the moisture held in the product equal to that held in the atmosphere. Thus, the rates of moisture desorption from the product to the environment and absorption from the environment are in equilibrium and the crop moisture content at this condition is known as the equilibrium moisture content. Under ambient condition, the drying process is slow, and in environment of high relative humidity, the equilibrium moisture content is insufficiently low for safe storage [6]. Due to hygroscopic properties of all agricultural products, during sun drying the crop can either be dried or rewetted [7]. Especially during night time when ambient temperature in general is decreasing, causing a simultaneous increase of humidity, remoisturing effects can occur either by condensation of dew or by vapour diffusion caused by osmotic or capillary forces.

Solar drying is a possible replacement for sun drying or for standard dehydration processes. The conditions in tropical countries make the use of solar energy for drying food practically attractive and environmentally sound [8]. In terms of sun drying, solar drying is competing with an approach that is deeply entrenched in the way of life for most potential users. Sun drying is by no means a perfect process with problem arising due to potential contamination of the produce variability in drying times, rain damage and so on. However some of the reasons proposed are as follows:

- Solar dryer have often been too expensive or initial investment capital or loan facilities were unavailable.
- Solar dryers have often been too complicated or poor training of local entrepreneurs and technicians were provided.
- Solar dryers have often require too big changes from traditional methods
- Solar dryers have not been built for long use.
- There is a lack of incentive to improve the quality of the product. People are willing to pay nearly the same amount for discoloured or damaged foods and there is therefore no incentive for producers to risk high amounts of money in a dryer when there is great return.

When comparing solar drying to conventional dehydration processes a new range of issue arises. There include:
Solar dryers must provide the equivalent performance to that of the conventional processes in terms of capacity, labour input, and the quality of the final product, the total drying cost and reliability.
A backup heating system should be installed to ensure drying during the critical periods when the weather is bad.
Advantages of solar drying can be summarized as follows:

- The higher temperature, movement of the air and lower humidity increases the rate of drying.
- Food is enclosed in the dryer and therefore protected from dusts, insects, birds and animals.
- The higher temperature deters insects and the faster drying rate reduces the rate of spoilage by microorganisms.

- The dryers are water proof and the food does not therefore need to be moved when it rains.
- Dryers can be constructed from locally available and are relatively low cost.
- More complete drying allows longer storage.

2. Materials and Method

Collection of materials.

The cassavas used were collected from crop science Department University of Nigeria, Nsukka. The farm is a mixed farm which is a mixture of cassava, vegetables and some fruits. The potato used was gotten from Opi in Nsukka Local Government Area of Enugu State. The cassavas were peeled to remove the back that will hinder drying of the produce.

Experimental Method

The peel cassava and potato were weighed and their weights were recorded. The reason for weighing the sample before putting them inside the drying chamber of the solar dryer is to ascertain the weight and compare it with the weight after drying. The temperature of the solar dryer was measure daily using thermometer inserted inside the dryer. The interior of the dryer was painted black to absorbed more solar radiation.

3. Results and Discussion

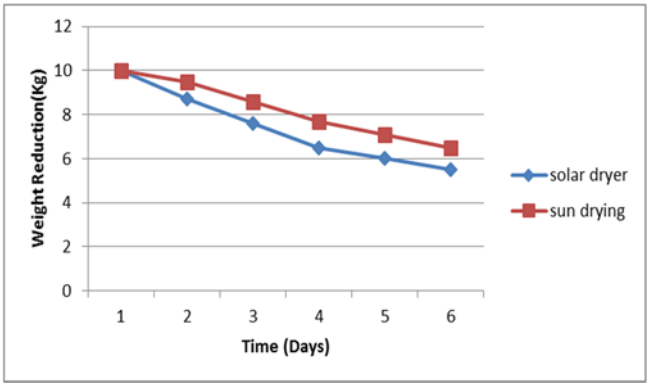

Fig 1: A graph of weight reduction cassava (Kg) versus Time (Days)

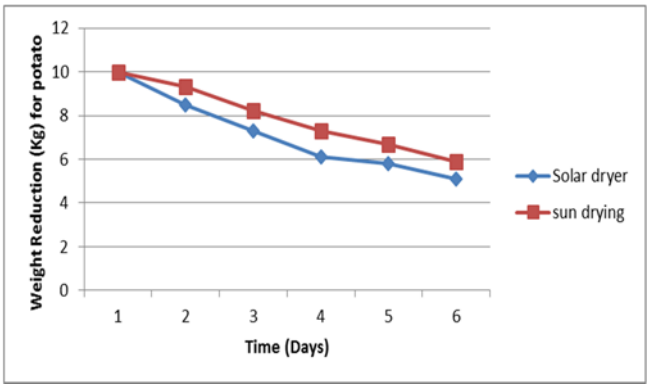

Fig 2: A graph of weight reduction of potato versus Time (Days)

The experiment indicated reduction in weight of both cassava and potato throughout the days of the experiment. The minimum weight of cassava and potato after drying for six days using solar dryer were 5.5Kg and 5.1Kg respectively. Using sun drying the weight of the two was found to be 6.5Kg and 5.9 Kg. It was observed that the solar radiation was not steady during the period of the experiment. The unsteady solar radiation resulted in the variation of weight loss of both cassava and potato. The maximum atmospheric temperature recorded during the experiment was 30 °C. There was no growth of micro-organism in the experiment while using solar dryer but in the case of sun drying there was growth of mucus because of poor weather condition which reduced solar intensity.

4. Conclusion

Solar dryer hastens drying of farm produce than sun drying though, sun drying retains the quality of farm produce after drying. The experiment performed indicated that solar drying using solar dryer is quite better than sun drying.

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