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# A study on dehydration of elephant foot yam (*Amorphophallus paeoniifolius* (Roxb.) under hot air oven drying systems

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**Abstract**
The Yam (*Amorphophallus paeoniifolius*), a popular vegetable, has significant levels of vitamins, antioxidants, anticarcinogenic chemicals, and glucosinolates. Elephant Foot Yam was blanched at three different temperatures of 70 °C, 80 °C and 90 °C for 300min in hot air oven to study their effect on drying characteristics of the Elephant foot yam. Evaluation of the Yam's nutritional status and drying behavior in a hot air-drying system is the main objective of this study. For the purpose of determining the initial moisture content, 10 g samples of Yam were collected in a drying container. The sample container spends 24 hours at 105 °C in the hot air oven. 85% (wb) of the initial moisture content was discovered. The impact of the chosen drying technique on the Yam's drying characteristics was investigated. 30 g samples of blanched and unblanched. Yam were dried at temperatures of 70 °C, 80 °C, and 90 °C under the hot air oven. It demonstrates that blanching is essential for weight and moisture loss. a brief period of blanching followed by 60 seconds of 90 °C cooking in a glass beaker.

**Keywords:** Elephant foot yam, hot air oven, moisture, weight loss, blanching

## Introduction

*Amorphophallus Paeoniifolius* (Roxb.) Nicolson, also referred to as Elephant foot yam, is a tropical underground stem tuber with great potential and a bounty of nutrients. It is a well-known vegetable in many Indian cuisines and a very good source of protein and starch. Elephant foot yam is a member of the Araceae family and is widely grown and consumed in south-east Asian nations like India, the Philippines, Malaysia, and Indonesia. Due to its limited commercial cultivation in many nations, it has significant export potential (Mishra *et al*. 2001) [5]. The complex unit operation of drying involves simultaneous mass and heat transfer, especially in transient conditions. It is one of the earliest techniques for extending the shelf life of perishable agricultural products by lowering their moisture content, which inhibits the growth of harmful microorganisms. As they are anti-inflammatory, anti-haemorrhoidal, astringent, haemostatic, digestive, appetiser, rejuvenating, and tonic, the tubers are used to prepare ayurvedic medicine. The plant starch is stable, easy to extract, and suitable for a wide range of applications in the food industry (S. N. Moorthy, 1994) [6]. It is known as the "King of Tuber Crops" due to its higher yield potential and culinary, medicinal, and therapeutic benefits decreasing water activity to increase shelf life (Sengupta, *et al*. 2008) [7]. Convective hot air drying was one of the most widely used drying methods. Food materials are exposed to high temperatures while drying, which increases shrinkage and toughness, lowers the dried product's capacity to rehydrate, and seriously damages flavour, colour, and nutritional content (Maskan *et al*. 2000) [2]. Due to poor heat conduction in common industrial dryers with hot air, drying takes longer and is less energy efficient. The use of microwave (MW) for drying has been taken into consideration in an effort to solve these issues and shorten drying times while maintaining quality.

The second most common reason for fruit and vegetable quality loss is enzyme-induced browning. Inactivation of Polyphenol Oxidase (PPO) is preferred for food preservation as it prevents enzymatic browning, which affects appearance and organoleptic properties, sensory quality, and nutritional quality (Samanta *et al*. 2010) [1]. Traditional hot water blanching of vegetables, which is widely used in industry, entails submerging the fresh product for a predetermined amount of time in hot water that is maintained at a constant temperature between 70 and 100 °C (P.J. Fellow 1988) [3].

Keeping the above points, the present investigation was carried out to use microwave heating in the beginning of drying to enhance the drying rate during convective drying of elephant foot yam, which could be significantly contributed to time and energy saving with quality product for food processing industry with following objectives:

- To optimize different blanching conditions and drying temperature on drying kinetics of elephant foot yam.
- To evaluate quality characteristics of dried products.

## Materials and Method

Before being taken for further processing, fresh Elephant foot Yams were rinsed under flowing tap water to remove any adherent soil. Fresh Yam had an initial 85% moisture content on a wet basis. The raw Yam was chopped into 3 centimeter pieces before drying. Two sets of fresh Yam were divided, one for blanching and the other for drying testing.

**Fig 1:** Sample of Fresh Yam

## Preparation of Sample

For the purpose of removing foreign matter such as dust, dirt, pollutants, and contaminated and spoiled Yam, unit operations such as cleaning, sorting, and size reduction will be done manually.

After washing and sorting the Yam slices to conduct the trial, 30 gm of samples with 5 replications were prepared. The Yam slices were stored in a refrigerator to conduct the trial at various time intervals.

**Table 1:** Preparation of Sample

| S. No | Activity variables | Labels | Measuring parameters |
|---|---|---|---|
| 1. | Drying method Hot air oven | 1 | Physical characteristics Moisture content |
| 2. | Temperatures (70 °C, 80 °C, 90 °C) | 3 | |

## Initial Moisture content

The AOAC 2000 method was used to assess the fresh Yam's moisture level. A 10 grammar test sample was kept in a digital hot air oven that was heated at 105 °C for 24 hours. The sample was removed from the oven after 24 hours and put in a desiccator to cool to room temperature. The sample's weight was exactly determined after cooling. The weight reduction was identified and is covered below.

$$MC\ \%\ (W.B.) = (M_{initial} - M_{final}) / (M_{initial}) \times 100$$

Where,

$M_{initial}$ = Initial weight of the sample (g)

$M_{final}$ = Final weight of the sample (g)

**Fig 2:** Dried sample, 24 hours at 105 °C

**Pre-treatment of Yam**

Fresh Yam was diced into 10mm pieces and blanched for 5 minutes at 80 °C. Figure 3 illustrates how the Yam's appearance was improved after blanching.

**Fig 3:** Blanched Yam at 80 °C for 5 minutes.

**Drying procedure**

In a hot air dryer with a 3 cm thick Yam, several temperatures in ten cities (70 °C, 80 °C, and 90 °C) were examined. The samples were put inside the dryer's chamber in the sample container, which is depicted in fig. 3. The Yam sample's change in mass and moisture over the course of drying was noted at intervals of 60, 120, 180, 240 and 300 minutes.

**Total ash**

By measuring 3 g of sample in a silica dish that had already been heated, incinerating first on a hot plate, then washing in a muffle furnace at a temperature of 540 °C as per the ISI method given in SP (1981), it was possible to calculate the total amount of ash in the powdered basil leaves. The terminal point was found to be white because of the ash's colour.

Total ash = 100 X (w2−w) $w1$

Where,
W2 = weight in gram of the crucible with ash,
W1 = weight in gram of the sample taken,
W = weight in gram empty crucible.

Harvesting of Elephant foot Yam root
↓
Kept in refrigerator before commencing the experiment
↓
Sterilization of required apparatus used in experiment
↓
Dressing of Yam roots
↓
Cleaning of Yam roots
↓
Sorting of Yam roots
↓
Washing of Yam roots
↓
(The samples were washed with the clean water to remove dirt and foreign matter and to get rid of the initial surface bound microbial load. Washing was done after dressing so as to avoid soil and dirt from the stems portion that present in the samples.)
↓
Slight pressing by using of blotting paper
↓
Blanching of Yam roots slices
(Blanching is an important intermediate thermal processing step to enhance preservation and quality of foods by inactivating enzymes that can cause loss of flavor and color. Blanching is generally used for color retention and enzyme inactivation of the food materials.)
↓
Blanching for a short time and cooking in a glass beaker in temperature 90 °C for 60 sec. After that separate the basil leaves from the beaker. Excess surface water from washed basil leaves was removed using blotting paper with slight pressing.
↓
Separation blanched water using filter paper
↓
Take both blanched and unblanched Yam slices samples in petri plates.
↓
Now keep the sample in hot air oven for drying at different temperatures (70, 80, 90 °C) for 300 minutes.
↓
Note down the reading of samples after a 60 minutes interval.
↓
After drying, samples are kept in the glass desiccator for cooling.
↓
After that dry slices are crushed to reduce the size of slices into powder form.

**Fig 4:** Flow chart of processing Yam powder

## Result and Discussion

### Initial Moisture Content

The hot air oven method was used to measure the moisture content percent (wb) in 10 g of fresh Yam. We discovered that the moisture content (wb) was 85%.

### Drying characteristics of Yam hot air oven

On Yam weight and moisture, the impact of drying was noted. The hot air oven was filled with 30 g, 1 cm long Yam. A number of readings were taken at each of the preset temperatures of 70 °C, 80 °C, and 90 °C every 60 minutes. As the temperature rose, the Yam's weight and moisture content fell.

### Effect of 70 °C on un-blanched Yam

For 300 minutes, the impact of 70 °C temperature on the weight of fresh Yam was investigated. 30 g of the sample was obtained, readings were taken every 60 minutes, and the total weight came to 5.54 g.

**Fig 5:** Unblanched Yam at 70 °C for 300 min

### Effect of 80 °C on un-blanched Yam

For a period of 300 minutes, the impact of an 80 °C temperature on the weight of fresh Yam was investigated. 30 g of the sample was obtained, readings were taken every 60 minutes, and the total weight came to 5.33 g.

**Fig 6:** Unblanched Yam at 80 °C for 300 min

### Effect of 90 °C on un-blanched Yam

For 300 minutes, the impact of 90 °C temperature on the weight of fresh Yam was investigated. 30 g of the sample was extracted, readings were performed every 60 minutes, and a final weight of 5.01 g was obtained.

**Fig 7:** Unblanched Yam at 90 °C for 300min

**Table 2:** Weight and moisture content unbranched Yam for 300 minutes

| S No. | Temperature | Final Weight (g) | Moisture (%) | Ash (g) |
|---|---|---|---|---|
| 1. | 70 | 5.54 | 18.14 | 3.56 |
| 2. | 80 | 5.33 | 16.14 | 3.89 |
| 3. | 90 | 5.01 | 14.53 | 4.11 |

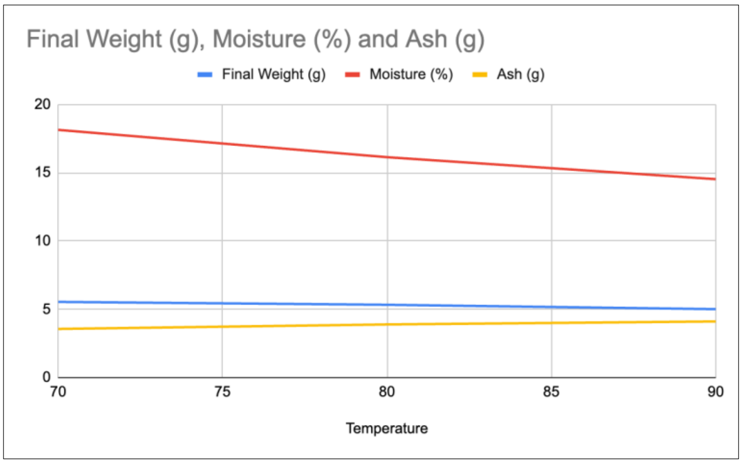


**Fig 8:** Effect of temperature on final weight of yam and moisture content of yam

**Effect of pre-treatment on the drying characteristics of Yam**

For a period of 300 minutes, the impact of blanching on the rate of moisture removal and weight loss of 1 cm cut Yams was investigated. Readings were taken every 60 minutes when the Yam sample was dehydrated at temperatures of 70 °C, 80 °C, and 90 °C. Although the dehydration rate was higher initially and later decreased in both situations, it was higher from blanched Yam samples than from unblanched Yam samples. This increase in moisture loss may have been brought on by tissues becoming looser from heat treatment.

Unblanched Yam dried to a lowest moisture content of 14.53% at 90 °C, while blanched Yam dried to a lowest moisture content of 5.17% at 90 °C. This shows that blanching has a considerable impact on the pace at which moisture is removed from Yams, with blanched samples removing moisture at a faster rate than unblanched samples. Additionally, the colour of the blanched Yam sample was superior to that of the unblanched Yam in Fig 10.

**Fig 9:** Sample of Blanched Yam

**Effect of 70 °C on blanched Yam**

During the experiment, the impact of 70 °C temperature on the weight of blanched Yam was examined. The sample was obtained in a 30 g quantity, and readings were made every 60 minutes. The Yam weight that was obtained with the least amount of drying. Comparing the final weight to the unblanched Yam, it was lower. 9.45 g was the final weight.

**Fig 10:** Blanched Yam at 70 °C for 300 min

**Effect of 80 °C on blanched Yam**

During the experiment, the impact of an 80 °C temperature on the weight of blanched Yam was examined. The sample was obtained in a 30 g quantity, and readings were made every 60 minutes. The Yam weight that was obtained with the least amount of drying. Comparing the final weight to the unblanched Yam, it was lower. 9.01 g was the final weight.

**Fig 11:** Blanched Yam at 80 °C for 300 min

**Effect of 90 °C on blanched Yam**

During the experiment, the impact of 90 °C temperature on the weight of blanched Yam was examined. The sample was obtained in a 30 g quantity, and readings were made every 60 minutes. The Yam weight that was obtained with the least amount of drying. Comparing the final weight to the unblanched Yam, it was lower. 8.87 g was the final weight.


**Fig 12:** Blanched Yam at 90 °C for 300 min

**Table 3:** Weight and moisture content of blanched Yam for 300 minutes

| S. No. | Temperature | Final Weight (g) | Moisture (%) | Ash (g) |
|---|---|---|---|---|
| 1. | 70 | 9.45 | 15.91 | 4.01 |
| 2. | 80 | 9.01 | 12.53 | 4.37 |
| 3. | 90 | 8.87 | 10.01 | 4.65 |

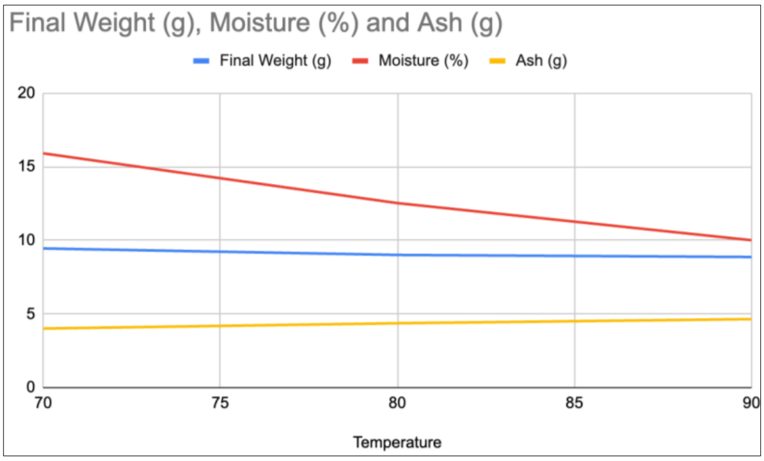


**Fig 13:** Effect of Temperature on Final weight of Yam and Moisture of Yam

## Summary and Conclusion

Under the current research project, a study on the impact of drying methods on physical characteristics of a Yam, the primary goal of drying was to reduce the qualitative and quantitative losses and to improve the storage quality of the output. The hot air oven was utilized for Yam drying. For the purpose of determining the initial moisture content, 10 g samples of Yam were collected in a drying container. The sample container spends 24 hours at 105 °C in the hot air oven. 85% (wb) of the initial moisture content was discovered. The impact of the chosen drying technique on the Yam's drying characteristics was investigated. 30 g samples of blanched and unblanched. Yam were dried at temperatures of 70 °C, 80 °C and 90 °C under the hot air oven.

As the temperature rises, the weight and moisture loss of the unblanched Yam sample both decrease in comparison to the blanched Yam. It demonstrates that blanching is essential for weight and moisture loss. a brief period of blanching followed by 60 seconds of 90 °C cooking in a glass beaker. Remove the basil leaves from the beaker next. Using blotting paper and light pressing, extra surface water was removed from cleaned Yam slices.

**The following conclusion could be drawn from the entire investigation on Yam drying under a hot air oven.**

1. Fresh Yam has a moisture level of 85% (wb).
2. As the drying temperature rises, the rate of moisture removal from the Yam sample increases.
3. Because the tissues were softened during pre-treatment, there was a significant rate of moisture removal from the blanched Yam sample.
4. Unblanched Yam had a moisture content of 14.53% at 90 °C, while blanched Yam had a moisture level of 12.61% at 60 °C.
5. The extremely low moisture content of blanched Yam, which indicates that blanching significantly affects the rate of moisture removal from Yam.

## Conflicts of interest

None

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**References**
1. Samanta A, Das S, Bhattacharyya P, Bandyopadhyay B. Inhibition of polyphenol oxidase in banana, apple and mushroom by using different anti-browning agents under different conditions, International Journal of Chemical Science. 2010;8(5):550-558.
2. Maskan M. Microwave/air and microwave finish drying of banana. Journal of Food Engineering. 2000;44:71-78.
3. Fellow PJ. Blanching- in food processing technology: principle and practice. London, UK; c1988. p. 201-208.
4. Ravi V, Ravindran CS, Suja G. Growth and Productivity of Elephant Foot Yam (*Amorphophallus paeoniifolius*) (Dennst. Nicolson): An Overview. Journal of Root Crops. 2009;35::131-142.
5. Misra RS, Shivlingaswamy TM, Maheshwari SK. Improved production technology for commercial and seed crops of elephant foot yam, Journal of Root Crops. 2001;27:197-201.
6. Moorthy SN. Tuber crop starches, Sreekariyam, Thiruvananthapuram, Kerala, India, Central Tuber crops Research Institute; c1994. p. 1- 40.
7. Sengupta S, Chowdhary BM, Singh BN, Ray RN. Status of elephant foot yam cultivation in Jharkhand, In: National Seminar on Amorphophallus: Innovative Technologies. Abstract Book, Status Papers and Extended Summary, 19-20, Patna, Bihar; c2008 July. p. 30-34.
8. Fellow PJ. Blanching- in food processing technology: principle and practice. London, UK; c1988. p. 201-208.