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Optimization and Shelf Life Evaluation of Plantain Pseudostem by Osmotic Dehydration

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Abstract:- The stem of a plantain eventually called the plantain pseudo-stem is rich in its fiber content used to make tea although the taste is bitter. Fortunately the stem or even the entire plant is going in vain, to make complete use of the pseudo-stem osmotic dehydration has been chosen as the method by research to preserve the food particle for a longer time which is said to be later incorporated during processing. Osmotic dehydration has gained popularity due to its effectiveness in preserving of fruits and vegetables; with the retention of initial characteristics i.e., color, aroma, texture and nutritional composition. This method involves less energy than any other drying process due to the processing at ambient temperatures .It has advantage sin the industry to maintain the food quality and to preserve the wholesomeness of food. Dehydration involves two stages where the water is removed using an osmotic agent and subsequent dehydration is a dryer further making the product shelf-stable.

Keywords:- *Osmotic Dehydration, Pseudo-Stem, Preservation, Shelf-Life Extension, Organoleptic Quality.*

I. INTRODUCTION

Banana is said to be nature's richest energy food that comes with the safety envelope; it is one of the widely cultivated crops in the tropical and subtropical zones. It is a perennial herbaceous plant that grows from a rhizome. The whole plant is a false stem which reaches to 2 to 6 meters. There are many techniques that are used in the processing and preservation of fruits and vegetables by drying but dehydration is chosen to be the best method in preserving the product for a longer period of time .The pseudo-stem of banana is said to contain several polymers such as cellulose, hemicellulose, pectin and lignin that contribute fibers with good mechanical properties. The banana pseudo-stem especially contains high amount of fiber and the chemical composition varies with age, variety, climatic conditions, geographical locations, preserving food to extend shelf-life, ensuring the safety and quality is a central pre-occupation of the food industry. By using the osmosis process 50% of original weight of vegetable (plantain stem) and further they are subjected to sun drying.

II. WHAT IS OSMOTIC DEHYDRATION?

Osmotic concentration or dehydration is the process of water removal from perishable such as fruits and vegetables because the cell membranes are semi-permeable and allow water to pass through them more rapidly than salt. During osmosis small quantity of acid is removed along with the water in the perishable (plantain stem).It is said to be a dynamic process in which the moisture and acid are removed first at an appreciable amount, which the salt penetration is very slight at first but later on increase with time. The characteristics of the product is said to vary depending upon the temperature, syrup concentration, time of osmosis to make the process faster.

III. APPLICATION OF OSMOSIS IN FOOD PROCESSING

The solution containing higher concentration of solute is called hypertonic solution which contains less concentration of solute. The main reason for the food to be spoiled and the growth of undesirable micro-organisms like the bacteria, molds and fungus on the surface of the food which utilizes the moisture and the temperature on the stored food to their growth, as a result there are undesirable changes in the aroma, smell and color. Osmotic dehydration is found to be the best method where the plantain stem is stored in brine solution. These solutions contain high amount of concentrated salts and are hypertonic to the cytoplasm of microorganisms resulting in dehydration followed by death of the invading microbes. To preserve it for a longer time further drying is needed.

A. Shape, Size and Thickness of the Edibles

Water loss is said to increase with increase in the surface area of the edibles. As researched by Panagiotou et all (1998) observed that the size of fruit samples has a negative impact on the water loss during the osmosis process and also observed that the distribution of water decreased with the raise in temperature and surface area with the increase in brine concentrations and the geometric dimensions between 3mm to 10mm for the perfect osmotic dehydration.

IV. OSMOTIC PROCESS PARAMETERS

A. Pretreatment

Pretreatment prior to osmotic water removal includes cleaning, blanching and freezing to enhance the product quality. Dipping in 1% citric acid solution prior to drying or osmotic dehydration was used to prevent the browning reactions or the discolourations.Dipping the stem in 0.4 percent ascorbic acid solution for 30 minutes prior to osmosis process lead to the highly acceptable product.

B. Immersion Time

The concentration of the solution is maintained constant, as there is an increase in the immersion time, there is said to be a tremendous increase in the water loss.It is indicated that during the osmotic treatment the mass exchange takes place at the maximum rate during the first two hours. Temperature of about 40℃ for 3 hours of immersion repeatedly for 3 times gave maximized water loss and brine gain, followed by drying in a hot air oven at a temperature of about 60℃ to attain a constant weight.

C. Temperature of the Osmotic Solution

Temperature of the osmotic solution affects the rate of osmosis. Treating the perishable(plantain stem) is said to be maintained at 60℃ which is sufficiently enough to destroy the cell membranes. Increased temperature would lead to the change in the texture, aroma and flavor which would also affect the parameters like water and salt gain of osmosis process.

D. Osmotic Agents

The osmosis is carried out with the osmotic reagents which commonly includes sucrose, glucose for fruits and sodium chloride for vegetables. The osmosis of plantain stem is carried out with the addition of sodium chloride (brine solution) in the ratio of 3:3:2 continuously for three consecutive times and ensure that they are dehydrated properly, the plantain stem is sliced to a dimension of 3mm to 10mm and are subjected to osmosis. Other osmotic agents include calcium chloride, mono-hydroxy ethanol and certain poly-hydroxy compounds.

E. Concentration and Agitation

Concentration is said to be the key factor in the osmotic dehydration process, higher is the concentration of the solution faster is the rate of osmosis.When plantain stem is agitated in the brine solution, the rate of osmosis will be faster due to reduced mass transfer rates.It is essential to use an optimum ratio since large ratios offers difficulties in handling the solution.

V. DRYING

Drying is a mass transfer process where the complete removal of water takes place by the evaporation from the component which tends to increase the shelf life of the product.Drying is said to be done prior to packaging and scaling and there are various methods employed in the drying process which includes sun drying, oven drying, vaccum drying or freeze drying; drying is most probably preferred as a medium which inhibits the growth of bacteria, mold and yeast through the removal of water. The drying process entailed in the preservation of plantain stem is sun drying and oven drying.

A. Sun Drying

The plantain stem after they are treated in the brine solution for about 3 days and they are spread flat on the trays and dried under the sun constantly until they are dried uniformly at a temperature of about 30-45℃ and the change in the size and shape takes place due to the exposure to the sun moisture get evaporated and there is said to be a change in the physical characteristics.

B. Oven Drying

The food compound is kept in brine solution in the ratio of 1:3 for about 3 days ensuring that the solution is absorbed properly. Now the pieces are spread uniformly on the flat plates or trays of the oven and they are treated for about 65-70℃ for maximum of 2 hours. This process is said to be continued until the entire moisture is removed and the product is said to attain uniform characterization.

VI. PACKAGING

The osmotically treated plantain stem are stored in air-tight containers of good quality and food grade and can be used to store osmotically dried foods. Aluminium foil, laminated polypropylene pouches are said to be good packing materials in order to prevent absorption of moisture from atmosphere. Dried plantain stem were kept at room temperature for about 8 months and there was no change in the quality.

VII. STORAGE OF OSMOTICALLY DEHYDRATED PLANTAIN STEM

The shelf life of the osmotically treated product is said to be maintained for about a period of 6 months to one year under suitable conditions and they are acceptable under a uniformly maintained room temperature; it has been depicted that maintaining relative humidity between 65-75% would be conductive for the retention of color, flavor, texture and taste of the plantain stem.

VIII. CONCLUSION

The osmotically treated plantain stem is said to have a shelf-life of about 8 months to one year depending on the storage conditions and the handling methods. Sun drying and oven drying methods were incorporated in the drying process but the oven drying is said to be an inappropriate method of drying due to the change in the quality and quantity of the product with the undesirable properties. Sun drying is said to be accepted due to the good quality and the nutrient retention with the prolonged shelf-life of the product as a wholesome product for the entire storage conditions.

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