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RESEARCH ARTICLE

STUDIES ON THE PHYSICOCHEMICAL PROPERTIES OF DRUMSTICKS PRESERVED BY OSMOTIC DEHYDRATION

***,[1] Shakila Banu, M., [2]Christy Arokia Trinita, B., [2]Nithya, T. and [2]Saranya C.R**

[1]Professor and Head, Department of Food Processing and Preservation Technology,
[2]Faculty of Engineering, Avinashilingam University for Women, Coimbatore

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ABSTRACT

Osmotic dehydration is a water removal technique, which is applied to fruits and vegetables, to reduce the content of the moisture, while increasing soluble solid content. The treated product has to be further processed by other drying techniques to obtain a shelf stable product. The osmotic dehydration technique not only enables the storage of the vegetables for a longer period, but also preserves flavor, nutritional characteristics and prevents microbial spoilage. Apart from this, problems of marketing, handling and transport becomes much simpler and all the horticultural produce could be made available throughout the year. A study was conducted on osmotic dehydration of drumstick which was treated in a osmotic solution of sodium chloride and citric acid followed by three methods of drying viz., sun drying, tray drying and vacuum drying. The quality of the product was determined by evaluating the physico–chemical characteristics such as color, texture, taste, flavor, ascorbic acid, calcium content and overall acceptability of drumsticks. The organoleptic analysis of the dehydrated drumstick showed that the best sample was that blanched in solution of 3% calcium chloride at 60°C for 2 minutes and sulphited to 3000 ppm with potassium metabisulphite and followed by osmotic treatment and drying in vacuum drier at 5mm Hg for 6 hours.

INTRODUCTION

Osmotic dehydration is an innovative technology of food preservation which reduces the moisture content of the produce for enhancing their shelf life. It is also known as infusion technique. It has been coined as dewatering and impregnation soaking (DIS) process. Osmotic dehydration is the process of partial removal of water in direct contact of the product with the hypertonic medium, i.e., a high concentration of salt solution for vegetable such as drumsticks. The driving force for water removal is the concentration gradient between the solution and the intracellular fluid. If the membrane is perfectly semi – permeable, solute is unable to diffuse through the membrane in food systems due to their complex internal structure, and there is always some solid diffusion into the food. The osmotic dehydration process is carried out relatively at low temperature and does not involve a phase change of water as in other dehydration processes. The treated product has to be further processed such as drying to obtain a shelf stable product; hence it can be used as a pretreatment. Osmotic dehydration ensures that the flavor and color losses are minimal and it also reduces the moisture to a greater extent with minimal heat damage. Osmotic dehydration, not only improves the texture and quality of the rehydrated product, but it also bestows a stable product by modifying the functional properties with substantial energy savings. Osmotically dehydrated product has superior organoleptic characteristics.

**Corresponding author:* hodfpntsv@gmail.com

METHODOLOGY

Usually, the fruits and vegetables are subjected to certain pretreatments before osmotic dehydration in order to minimize certain adverse changes occurring during drying and subsequent storage.

a. **Blanching**

Blanching of fruits and vegetables is invariably practiced in drying process. It inactivates polyphenoloxidase, the enzyme responsible for browning during storage, reduces drying time, ensure removal of intra-cellular air and softening of texture. It also improves the flavor by removing undesirable acid elements and astringent taste. Blanching can be done using chemicals for improving the textural qualities. Many plant tissues soften during processing and get collapsed. Addition of calcium salts to the fruits and vegetables establishes a calcium-pectate gel, which supports the cells in maintaining their structure (Norman Desrosier and James, 1977). The firming action of calcium in processed vegetables has been studied (Mc Feeters, 1986: Hoogzand and Doesburg, 1992). Calcium chloride protects against softening by binding to the galacturonans or pectic substances. The complex that is formed is resistant to depolymerisation by hydrolases (Buescher and Hudson, 1984). The fresh drumsticks were cut into optimal sizes and blanched (anhydrous pure, food grade

calcium chloride) at temperatures of 40°C to 60°C for 1, 2 and 3 minutes and dried at 40°C-50°C for 4-5 hours. Based on sensory evaluation, the drumsticks blanched at 60°C for 2 minutes followed by drying, showed very meager discoloration. The other criteria such as flavor and texture were retained and ultimately the overall quality was found to be better .

b.Sulphiting

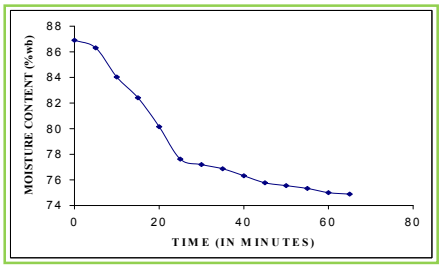
Sulphur dioxide is more effective against molds and bacteria than yeasts (Norman Desrosier and James, 1977). In addition, it acts as an antioxidant and bleaching agent. These properties help in the retension of ascorbic acid, carotene and other oxidizable compounds. It also retards the development of non enzymatic browning (Srivastava, Sanjeev Kumar, 1998). Powdered, food grade potassium metabisulphate was used for the sulphitation of the drumsticks (1000 ppm to 7000ppm). Results indicated that drumstick samples that were blanched at 60°C for 2 minutes and treated with solution containing 2% calcium chloride followed by sulphitation(3000ppm) and drying, showed good results with better appearance and colour retention and also possessed better overall acceptability.

Drumstick Sample After Blanching and Sulphitation

c. Osmotic Treatment

The treated samples were subjected to osmosis in solutions containing varying concentrations of sodium chloride (10 to 30 %) and citric acid (0.025 to 0.075 %). When the drumstick samples are immersed in hypertonic osmotic solution, the reduction in moisture content occurred which is due to the concentration gradient existing between them. Initially, the removal of moisture was at a higher rate. After 45 minutes, the concentration gradient declined and by one hour, it had greatly reduced resulting in negligible change in corresponding weights.

On further continuation of the process gain in weight of the product was observed due to the deposition of solute and hence osmotic treatment was carried out for one hour. The osmotic dehydration characteristic curve in Figure no. 1.of the best sample, (drumstick blanched in a solution containing 3% calcium chloride at 60°C for 2 minutes and sulphited with 3000 ppm potassium metabisulphite, when immersed in an osmotic solution of 30% sodium chloride and 0.075% citric acid, maintained at a temperature of 50°C). In order to obtain better osmosis process the solution to sample ratio was optimized as 6.



Osmosis Characteristics Curve Of Drumstick

EFFECT OF DRYING

The samples after osmosis were uniformly spread and dried for 6 hours in a vacuum drier (5 mm Hg).The loss in weight of the drumsticks after drying is given by the dehydration ratio and the capacity of the material to regain its original property is given by rehydration ratio. The dehydration and rehydration characteristics of the best sample are given in Table below:

Treatment	Weight before dehydration(g)	Weight after dehydration(g)	Dehydration ratio
Osmotically	50	30.36	1.64
dehydrated	Weight before	Weight after	Rehydration
Drumstick(vacuum	Rehydration (g)	Rehydration (g)	Ratio
Drying)	5	6.48	1.296

Physico-Chemical Analysis for Osmotically Dehydrated Drumstick Samples

Various tests were done with measured quantity of drumstick samples to assess the following parameters.

♦ Moisture content;♦ Dry matter content;♦ Ash content;♦Ascorbic acid content and ♦Calcium content

Treatment	Moisture content (%wb)	Dry matter content (%)	Total ash content (%)	Ascorbic acid content (mg / 100g)	Calcium content (mg /100g)
Fresh sample	86.9	13.1	2	120	30
Treated sample	8.23	91.77	43.5	67	24

Conclusion

The application of osmotic treatment to the drumsticks and further drying of them is an attempt to retard physiological deterioration (due to the growth of micro organism, increased water activity and chemical reactions) to ensure maximum retention of quality and nutrients and extend the shelf life.

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