e-ISSN:2321-6204
p-ISSN:2347-2359

Preservation Through Osmotic Dehydration

Muhammad Zeeshan[1*], Muhammad Ayub[2] and Arslan Khan[3]

[1]Agricultural Research Institute, D. I. Khan, Pakistan
[2]University of Agriculture, Peshawar, Pakistan
[3]Agricultural Research Institute, Tarnab, Peshawar, Pakistan

Research Article

Received Date: 21/10/2016
Accepted Date: 04/11/2016
Published Date: 11/11/2016

***For Correspondence**

Muhammad Zeeshan, Agricultural Research Institute, D. I. Khan, Pakistan, Tel: +92-961-740184

E-mail: zeeshanfst07@gmail.com

Keywords: Osmotic dehydration, Osmotic agents, Fruits, Vegetables

ABSTRACT

Osmotic dehydration refers to the partial removal of water through osmosis, in which fruits and vegetables are immersed in hypertonic solution for a given period of time. This process received considerable attention in contemporary years for the dehydration of fruits and vegetables. This process can be used for a variety of fruits and vegetables. The benefit of this process is that it retains the original characteristics of fruits and vegetables. It consumes less energy and the product can be dried after pre-treatment in dehydrator or even in sunlight. This process is carried out in two stages, 1st the elimination of moisture by an osmotic agent and then dehydration in dryer or in sunlight to further reduced the extent of moisture and makes it a stable product.

INTRODUCTION

Fruits and vegetables are important to human diet. Worldwide, production of fruit every year is over 475 million tons. Top producer in the world are United States, India, Brazil, and China. Fruits and vegetables are valuable sources of vitamins, minerals, and fiber and are low in fat and calories [1].

Fruits and vegetables are perishable commodities and the post harvest losses are very high. For minimizing these losses preservation needs to be done. Preservation of fruits and vegetables can be done by various methods; the most significant among them is preservation by osmotic dehydration. The benefit of this process is that it retains the original color, flavor, taste and most importantly the nutritional composition of fruits and vegetables [2]. Another benefit of the process is that it is least expensive and the energy consumption is very low. This process is conducted in two stages, i.e. immersion in hypertonic solution for a given period of time and then dehydration using dehydrator to reduce the moisture content [3].

This process works on the principle osmotic pressure. Moisture within the fruits and vegetables migrates through a semi permeable membrane into the solution where the moisture content is lower as compare to fruits and vegetables while the solid content moves from hypertonic solution to inside the fruits and vegetables where the solid content in lesser as compare to the solution.

Quality of Raw Material for Osmotic Dehydration Process

In fruits and vegetables the moisture content depends and varies among maturity stage and variety. Fully ripened fruits and vegetables suits well for the production of osmotic dehydrated products [4].

Fruit size, shape and thickness also play important role in this preservation technique. Fruit size and water loss has an inverse relation in osmotic process [5]. In osmotic dehydration process sample size should be 3 mm to 10 mm and could be of any shape [6].

Osmotic Process Parameters

Pretreatment

Any pretreatment like blanching or freezing is not good for the quality of the product. Citric acid at a concentration of 1 percent can be used before the process for prevention of browning. Discoloration can be prevented by dipping in alkaline or acid solution prior to the process [7,8]. Dipping mango and papaya slices in 0.4% ascorbic acid solution or 0.4% ascorbic acid with the addition 0.1% potassium metabisulphite solution for approximately 25-30 minutes prior to the process gives a high quality product [9].

Time of immersion and temperature of solution

Removal of water increase as time of immersion increase. First two hrs are important for the mass exchange in Osmotic dehydration process, because transfer of mass is high in these 2 hours. Optimum solute gain and water loss obtained at a temperature of 500 when banana and apple slices were dipped for 3 hours in 70 and 500 Brix [10]. Temperature of 60°C with air velocity of 2 m/s until constant wt is obtained gives best result. At 60°C the rate of transfer increases. Temperature of solution greatly affects the solid gain and water loss during the process [2].

Osmotic agents, its concentration and agitation

Normally osmotic agents used for vegetable is NaCl and sucrose, glucose and fructose for fruits. $CaCl_2$, maltdextrin and lactose can also be used alone or in combination at various concentration as an osmotic agents. Rate of solid gain and water loss increase as the temperature of solution and rate of sugar concentration increase [6]. For osmotic dehydration 0brix of 60-70 is optimum for mass transfer [11].

The rate of mass transfer is higher when fruits and vegetables are agitated in syrup. Constant agitation increase water loss and solid gain during osmosis [9].

Fruit to solution ratio

Optimum fruit to solution ration is must for better result of osmotic dehydration process. Tiwari [4] suggest that ratio of 1:2 or 1:3 gives good result for practical purpose.

Mass Exchange in Osmotic Dehydration

Three types of mass transfer occur in osmotic dehydration process [4,12].

1. Flow of water from Water flow from product to syrup.
2. Transfer of solute from syrup to product, a solute may be desired nutritional ingredient or a preservative.
3. Transfer of solute from fruits or vegetable to solution. The solute may be organic acids, vitamins, minerals etc. but this transfer of solute is quite negligible as compare to the transfer of the above type of transfer.

Drying of Osmotic Fruits/Vegetables

HTST is possible of products having low moisture content. Normally the process may not give the desired moisture level of the product to be store for longer period. Using oven drying product should be further dried (air or vacuum) or sun drying to obtain a shelf stable product [3].

Packaging and Storage

Aluminum foil, laminated polypropylene pouches can be used for packing osmotically dehydrated product [13]. For osmo-dried papaya high density polyethylene can be used. Papaya slices remain stable up to 6 months. The storage may vary from 6 months to 1 year [14].

Microbial Study of O.D Products

Ramarjuna and Jayaraman [15] studied that osmotically dehydrated product is microbiologically safe when kept at room temperature or above room temperature and when kept at 0˚C the microbes appear. The total plate count was 230-300 colonies/g. Also when the product is treated with salt like sodium benzoate it lowers the risk of microbial attack. A research was conducted on fig toffee for counting microbes after 6 month of preservation, among the treatment, the one which was treated with sodium benzoate, was having low microbial count as compare to the non-treated samples [16].

Advantages of Osmotic Dehydration

The main pros of osmotic dehydration are

1. It retains the shape, natural qualities and wholesomeness of fruits and vegetables.
2. It minimizes cost of processing energy consumption.
3. Inhibits enzymatic browning and improves organoleptic characteristic of the product.
4. As the product is immersed in solution, it is not exposing to O_2, so the product retains it natural color.
5. Reduce volume of the product.
6. Less time consuming.

e-ISSN:2321-6204
p-ISSN:2347-2359

CONCLUSION

Among various methods of preservation of fruits and vegetables, osmotic dehydration is simple and effective method. By this process the product retains its original color, flavor, taste, and nutritional qualities as compare to other drying and preservation methods. Keeping in view the benefits and advantages of this process, in the nearby future, consumers will prefer products which are preserved by osmotic dehydration.

REFERENCES

1. Srivastava RP and Sanjeev K. Fruit and Vegetable Preservation, Principles and Practices. Army printing press Lucknow India. 2002;11-20.
2. Pokharkar SM. Studies on osmotic concentration and air-drying of pineapple slices. Ph.D. Thesis, Department of Agril. Engineering, Indian Institute of Technology, Kharagpur. 1994;22-68.
3. Pointing JD. Osmotic dehydration of fruits, recent modifications and applications. J. Process Bio Technology. 1973;12:8-20.
4. Tiwari, R. B. Application of Osmo air dehydration for processing of tropical fruits in rural areas. Indian Food Industry. 2005;24:62-69.
5. Panagiotou NM, et al. Mass transfer modeling of the osmotic dehydration of some fruits. Int. J. Food Sci. Technol. 1998;33:267-284.
6. Rahman MS and Lamb J. Air-drying behaviour of fresh and osmotically dehydrated pineapples. J. Food Process Engi. 1991;14:163-171.
7. Hussian I, et al. Effect of sucrose and glucose mixture on the quality characteristics of osmotically dehydrated banana slices. Pakistan J. Nutrition. 2004;46:83-92.
8. Sunkja PS and Ragharan GSV. Assessment of pre treatment methods and osmotic dehydration of Cranberries. J. Canadian Bio systems. 2004;46:52-56.
9. Torreggiani D. Osmotic dehydration in fruit and vegetable processing. Food Res. Intl. 1993;26:59-68.
10. Mauro AM, et al. Vacuum drying of osmotic dehydrated apple slices. Drying, Proceedings of the 14 th International drying Symposium, Brazil. 2004.
11. Chaudhari AP, et al. Osmotic dehydration of fruits and vegetables. Indian Food Industry. 1993;12:20-27.
12. Karthiayani A. Osmotic dehydration of fruits and vegetables with special reference to vacuum treatment. Food and Pack. 2004;39:82-84.
13. Sagar VS and Khurdiya DS. Studies on dehydration of Dashehari mango slices. Indian Food Pack. 1999;53:5-9.
14. Ahemed J and Choudhary DR. Osmotic dehydration of papaya. Indian Food Pack. 1995;49:5-11.
15. Ramarjuna MN and Jayaraman KS. Studies on the preparation and storage stability of intermediate banana. J. Food Sci. Technol. 1980;17:183.
16. Khandekar SV, et al. Preservation of pulp and preparation of toffee from fig fruit. Beverage and Food World. 2005;32:55-56.