International Journal of Pharmacy & Life Sciences
Open Access to Researcher

A Review on Osmo-Convective Dehydration of Papaya (*Carica Pa Paya* L.) Slices

Vikrant Kumar[1*], Mohd Nayeem Ali[1] and Anjali Jakhar[1]

Assistant Professor Department of Agriculture[1]
Shri Ram College, Muzaffarnagar (UP), India

Article info

Received: 19/09/23

Revised: 11/10/2023

Accepted: 23/11/2023

© IJPLS

www.ijplsjournal.com

Abstract
Osmotic dehydration (OD) is one of most important complementary treatment and food preservation technique in the processing of dehydrated foods, since it presents some benefits such as reducing the damage of heat to the flavor, color, inhibiting the browning of enzymes and decrease the energy costs. Osmotic dehydration results in increased shelf-life, little bit loss of aroma in dried and semidried food stuffs, lessening the load of freezing and to freeze the food without causing unnecessary changes in texture. Drying is a technique of conservation that consists of the elimination of large amount of water present in a food by the application of heat under controlled conditions, with the objective to diminish the chemical, enzymatic and microbiological activities that are responsible for the deterioration of foods. Hot air drying often degrades the product quality, provides low energy efficiency and lengthy drying time during the falling rate period.
It has been reported that hot-air drying of food materials, involving their prolonged exposure to elevated drying temperatures, results in substantial deterioration of such quality attributes as color, nutrient concentration, flavor and texture. Papaya (*Carica papay* L.) is an important fruit crop grown widely in tropical and subtropical low land regions. Excellent in vitamin C, pro-vitamin A, minerals as well as rich in dietary fiber, papaya is emerging as a popular fresh fruit which offers health benefiting properties. The desire to eliminate this problem, prevent significant quality loss and achieve fast and effective thermal processing, has resulted in the increasing use of microwaves for food drying.
Keywords: Papaya, Osmotic dehydration, Drying and papaya fruit etc.

Introduction

Osmotic dehydration (OD) is one of most important complementary treatment and food preservation technique in the processing of dehydrated foods, since it presents some benefits such as reducing the damage of heat to the flavor, color, inhibiting the browning of enzymes and decrease the energy costs (Alakali, 2006 & Torres, 2006). Osmotic dehydration results in increased shelf-life, little bit loss of aroma in dried and semidried food stuffs, lessening the load of freezing and to freeze the food without causing unnecessary changes in texture (Petrotos, 2001). It has been reported that osmotic dehydration reduced up to 50% weight of fresh vegetables and fruits (Rastogi, 1997). Papaya (*Carica papaya* L.) is a tropical fruit having commercial importance because of its high nutritive and medicinal value. Total annual world production is estimated at 6 million tonnes of fruits.

***Corresponding Author**
E.mail: vkvk6096@gmail.com

ISSN: 0976-7126
Kumar *et al.,* 14(10-12):36-40, 2023

B India leads the world in papaya production with an annual output of about 3 million tonnes. Alone in Andhra Pradesh the total area under cultivation is 11.2 thousand hectare and productivity is 100 MT/Hactare. Despite large acreage of land devoted to papaya the fruit loss is reported to be between 40-100 per cent of total annual produce. (Source: Database of National Horticulture Board, Ministry of Agriculture, Govt. of India).

The process flow chart for osmo-convective dehydration of papaya slice

Fresh papaya
⇓
Washing
⇓
Peeling
⇓
Cut into slices
⇓
Pretreatments (T_1, T_2, T_3, T_4)
⇓
Osmotic treatment Dip in Sugar solution (55, 65°Brix)
⇓
Immersion time (3 hr.)
⇓
Osmotically papaya slices
⇓
Tray drying at 60°C
Hot air oven drying at 60°C
⇓
Packaging and Quality Analysis

Application of Osmosis

The osmotic dehydration process and influence of its process variables such as pretreatment, temperature of sugar solution and additives on the mass transfer in osmotic dehydration of various fruits was studied by (11) and reported that the apple slices reduced to 50 per cent of original weight by using 60–70° Brix sugar solution and superior quality. The study also indicated that there was no need of sulphur dioxide treatment to prevent loss of colour. The osmotic air-dried products were high in superior quality and reported that the osmosis process removed water from fruits and vegetables slices to the extent of 40 – 50 per cent of the weight, but not enough for storage. Therefore, to remove water up to safe levels further drying is needed.

Osmotic Process Parameters

1. Pretreatments
2. Immersion time
3. Temperature of the osmotic solution
4. Osmotic agents
5. Concentration of osmotic solution
6. Circulation
7. Fruit pieces to osmotic solution

Osmotic dehydration treatment

The osmotic agent used was sucrose and the osmotic solution was prepared by dissolving the required quantity of sugar in distilled water to make 50, 55 and 60 ^{o}brix solution. Papaya fruit slices, previously weighed and identified, were immersed in the osmotic solution of given concentration (50%, 55%, and 60 %, w/w) and temperature (50°C) during a given immersion time (30 min). The weight ratio of osmotic medium to fruit samples was 5:1 to avoid significant dilution of the medium and subsequent decrease of the driving force during the process. After removed from the sugar solution, samples were drained and the excess of solution at the surface was removed with absorbent paper for posterior weight. The moisture content of the samples was gravimetrically measured using a vacuum oven at 70 °C for 24 h.

Determination of Moisture Content: Moisture content (w.b.) of the osmotically treated papaya slices was determined according to oven method (AOCC, 1990). 1 g of sample was accurately weighed into a clean dry petri dish and dried in an oven at 105°C for 6-8 hrs. It was then cooled in a desiccators and weighed. This was repeated till a constant weight was obtained. The moisture content was expressed as % of sample mix.

$$\text{Moisture \% (Wb.)} = \frac{W1-W2}{W1-W0} \times 100$$

Where,
W0 = Weight of petri dish (g),
W1 = Weight of petri dish + sample (g),
W2 = Weight of petri dish + dried sample (g).

Determination of water loss (WL) and solid gain (SG).

Osmotic dehydrated samples were blotted with tissue paper and later weighed for determination of WL and SG as shown by the following equation **(Aktas *et al*., 2007)**

$$WL = \frac{Wwo - Ww}{Wo} \times 100$$

$$SG = \frac{Ws - Wso}{Wo} \times 100$$

$$MR = WL - SG$$

ISSN: 0976-7126
Kumar *et al.,* 14(10-12):36-40, 2023

Where, WL, SG and MS are Water Loss, Solid Gain and Mass Reduction in %, respectively.
W_{wo} is the initial water mass,
W_w is the mass of water at time t,
W_S is the solid mass at time t,
W_{so} is the initial solid mass

Rehydration ratio

Rehydration tests for dehydrated samples were carried out by immersing 5 g sample in 50 ml distilled water at 35°C in a 100 ml beaker kept in a hot water bath to maintain a water temperature of 35°C for 5 hr. Dehydrated samples were evaluated for rehydration ratio, from the weight before and after the rehydration.

$$Rehydration\ Ratio\ (RR) \frac{C}{D}$$

Where,
C =drained weight of rehydrated sample (g)
D = test weight of dehydrated samples (g)

Sensory Evaluation

Sensory evaluation is important to access the consumer's requirements. It is difficult to classify 100% by machine because it was a subjective factor. Dehydrated product should have a typical taste, flavor, and texture. To test these organoleptic characteristics, sensory evaluation was done on the basis of 9 points hedonic scale. The sensory evaluation was carried out for taste, color and overall acceptability. A sample of dehydrated product was served for the evaluation to a 10 panelists at a time. The score sheet was provided with product and of all the panelists was computed on 9 point hedonic scale.

Table 1: Point hedonic scale for sensory evaluation

Sr. No.	Feeling	Rating
1	Like extremely	9
2	Like very much	8
3	Like moderately	7
4	Like slightly	6
5	Neither like nor dislike	5
6	Dislike slightly	4
7	Dislike moderate	3
8	Dislike very much	2
9	Dislike extremely	1

Advantages of osmotic dehydration

1. It minimizes the effect of temperature on food quality and preserves the wholeness of the food, as no high temperature/phase change is required in the process.
2. Mild heat treatment favors color and flavor retention resulting in the product having superior organoleptic characteristics. It is more when sugar syrup is used as osmotic agent.
3. It increases resistance to heat treatment.
4. The process is quite simple and economical.
5. It prevents the enzymatic browning and inhibits activities of polyphenol oxidases.
6. It improves the texture and rehydration properties.
7. The blanching process may be eliminated by this process, which reduces cost of processing.
8. Acid removal and sugar uptake by fruits modifies the composition and improves the taste and acceptability which is called candying effect.
9. The process could prove to be good for production of the ready to eat foods such as raisins etc.
10. The process reduces volume of the products thereby saving in the cost of processing, storage and transport.
11. Constant immersion of product in osmotic agents avoids the O2 exposure, the product retains better color.
12. It protects against the structural collapse of the product during subsequent drying. It helps to retain the shape of the dehydrated products.

Conclusion

Osmotic dehydration is simple and effective treatment and preservation technique for preserve the food for long storage period. Osmotic dehydration having some profits like as reduces the damage of heat to the color and flavor, in this process the product having its real color, flavor, taste, and nutritional qualities as compare to other drying and preservation techniques. The osmotic dehydration process also concerned the quality and nutrition value of food product.

References

1. Ahemed, J. and Choudhary, D.R. 1995. Osmotic dehydration of papaya. *Indian Food Pack,* 49 : 5-11.
2. Alakali, J.S., C.C. Ariahu and N.N. Nkpa. 2006. Kinetics of osmotic dehydration of mango. *Journal of Food Processing and Preservation,* 30: 597-607.
3. AOAC. (1990). Official methods of analysis. 14?? Edition. Edited by Sidney williums. Published by. The Association of official analysis chemists, Inc. Arlinton, Virginia, 22209, USA
4. Azuara, E and C.I. Beristain. 2002. Osmotic dehydration of apples by immersion in concentrated sucrose matlodextrin solution. *Journal of Food Processing hesewation,* 26: 295-306.
5. Barnabas M, Siores E, Lamb A 2010. Non-thermal microwave reduction of pathogenic cellular population. *Int. J. Food Eng.* 6: 1-18.
6. Behsnilian, D. and Spiess. W.E. 2006. Osmotic dehydration of fruits and vegetables. IUFOST
7. Bongirwar, D. R. & Sreenivasan, A. 1977. Osmotic dehydration of banana. *J. Food Sci. Technol,* 14 (3) : 104-112.
8. Chavan. U.D. 2012. Osmotic dehydration process for preservation of fruits and vegetables. *Journal of Food Research. Vol.* 1(2): 202-209.
9. Conway, J., Castaigne, F., Picard, G. and Vovan, X. 1983. Mass transfer consideration in the osmotic dehydration apples, journal of food science and technology, 16: 25-29.
10. El-Aouar. A.A., Azoubel. M.P.,Jr. Barbosa. L.j. and Murr. X.E.F. 2006. Influence of the osmotic agent on the osmotic dehydration of papaya (*Carica papaya* L.). *Journal of Food Engineering,* 75: 267-274.
11. Erle, U. and H. Schubert. 2001. Combined osmotic and microwave-vacuum dehydration of apples and strawberries. *Journal of Food Engineering,* 49: 193-199.
12. Geohive 2014. Geohive World Crop Production www.geohive.com/charts/ag_crops.aspx
13. Kalyani. B.S.B., Reddy. S.B., Kalyani. U.p., Devi. H.V., Ravi. L. and Shanti.M., Singh, E. 2015. Study On Dehydration of Papaya Slices Using Osmotic Dehydration Mediated Hot Air Oven Drying, 9(2): 72-95.
14. Khan Rafiq Moazzam. 2012. Osmotic dehydration technique for fruit preservation. *Pakistan journal of food science,* 22(2): 71-85.
15. Lazarides, HN. 2001. Reasons and possibilities to control solids uptake during osmotic treatment of fruits and vegetables. pp. 33–42.
16. Lenart, A. 1996. Osmo-convective drying of fruits and vegetables: technology and application. Drying Technology, 14 : 391–413.
17. Mauro MA, Menegalli FC 2003. Evaluation of water and sucrose diffusion coefficients in potato tissue during osmotic concentration. *J. Food Eng.* 57: 367-374.
18. Okos, M.R., Narsimham, G., Singh, R.K. and Witnauer, A.C. 1992. Food dehydration. In D. R. Heldman & D. B. Lund (Eds.), Handbook of food engineering. New York: Marcel Dekker.
19. Petchi M., Manivasagan R. 2009. Optimization of osmotic dehydration of radish in salt solution using response surface methodology. *Int. J. Food Eng.* 5: 1-11.
20. Petrotos, K.B. and H.N. Lazarides. 2001. Osmotic concentration of liquid foods. *Journal of Food Engineering.* 49: 201-206.
21. Pointing, J. D., Watterss, G. G., Forrey, R. R., Stangly, W. L., & Jackson, R. 1966. Osmotic dehydration of fruits. *J. Food Sci. Technol,* 20 (10): 125-128.
22. Rahman, M. S., & Lamb, J. 1991. Air-drying behavior of fresh and osmotically dehydrated pineapples. *J. Food Process Engi,* 14, 163-171.
23. Rahman, M. S., & Perera, C. O. 1999. Drying and food preservation. In M.S. Rahman (Ed.), Handbook of food preservation New York: Marcel Dekker,

173–216.
24. Rastogi, NK and K. Raghavarao. 1997. Water and solute diffusion coefficients of carrot as a function of temperature and concentration during osmotic dehydration. *Journal of Food Engineering*, 34: 429-440.
25. Sablani, S. S., Rahman, M. S., & Al-Sadeiri, D. S. 2002. Equilibrium distribution data for osmotic drying of apple cubes in sugar-water solution. *Journal of Food Engineering*, 52: 193–199.
26. Sagar, V.S. and Khurdiya, D.S. 1999. Studies on dehydration of Dashehari mango slices. *Indian Food Pack*, 53(1): 5-9.
27. Singh, B., P.S. Panesar and V. Nanda, 2008. Osmotic dehydration kinetics of carrot cubes in sodium chloride solution. *International Journal of Food Science and Technology*, 43: 1361-1370.
28. Singh, B., Panesar, P. S. and Nanda, V. 2008. Osmotic dehydration kinetics of carrot cubes in sodium chloride solution. *International Journal of Food Science and Technology*, 43: 1361-1370.
29. Sousa, P.H.M., Souza Neto M.A., Maia, G.A., Souza Filho, M.S.M. and Figueiredo, R.W. 2003. Desidratação osmótica de frutos. *Boletim da Sociedade Brasileira de Ciência e Tecnologia de Alimentos*, 37: 94-100.
30. Taiwo, K.A., M.N. Eshtiaghi, B.I.O. Ade-Omowaye and D. Knorr. 2003. Osmotic dehydration of strawberry halves: influence of osmotic agents and pretreatment methods on mass transfer and product characteristics. *International Journal of Food Science and Technology*, 38: 693-707.
31. Torreggiani, D. and Bertolo, G. 2001a. Highquality fruit and vegetable products using combined processes. In Osmotic Dehydration and Vacuum Impregnation, Fito. P., Chiralt. A., Bara.t J. M., Spiess. W. E., and Behsnilian. D. (Editors). Lancaster, PA: Technomic Publishing Company, Inc.
32. Torres, J.D., P. Talens and I.A Escriche. 2006. Chiralt Influence of process conditions on mechanical properties of osmotically dehydrated mango. *Journal of Food Engineering*. 74: 240-246.
33. Yeomans. S.J. and Yang. S.X. 2014. Determining optimal osmotic drying parameters for papaya using the firefly algorithm. *Lecture notes in management science*,6: 32-39.
34. Yousefi. A., Niakousari. M., Moradi. M. 2013. Microwave assisted hot air drying of papaya (Carica papaya L.) pretreated in osmotic solution. *African journal of Agricultural Research*, vol. 8, (25): 3229-32

Cite this article as:
Kumar V., Ali Mohd. N. and Jakhar A. (2023). A Review on Osmo-Convective Dehydration of Papaya (*Carica Pa Paya* L.) Slices.. *Int. J. of Pharm. & Life Sci.*, 14(10-12): 36-40.

Source of Support: Nil
Conflict of Interest: Not declared
For reprints contact: ijplsjournal@gmail.com