Effect of Osmotic Dehydration on Quality Characteristics of Chikoo Slices

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Abstract

Osmotic dehydration of Chikoo for partial removal of water by immersing fruit slices in sucrose solution was carried out in order to study the effect of process parameters such as concentration and temperature of osmotic agent on quality characteristics of the fruit. Chikoo slices were osmotically dehydrated by immersing 30, 40 and 50° Brix sucrose solution at 30, 40 and 50 °C temperature for one hour. After dehydration, Chikoo were dried under 20 W microwave powers. To evaluate the effect of above mentioned parameter physico-chemical evaluation such as dehydration ratio, rehydration ratio, moisture content, titratable acidity, pH, Browning and Vitamin C content were carried out. Sensory analysis was carried out according to the 9 point hedonic scale.

The physicochemical analysis of the dehydrated Chikoo suggested that increasing concentration and treatment temperature resulted in increased dehydration ratio. The quality analysis showed that the acidity of fruit shifted towards neutrality, vitamin C content and the extent of browning decreased as the concentration of osmotic solution and treatment temperature increased.

Keywords: Chikoo, osmotic dehydration, quality analysis

Introduction

Chikoo (Achras zapota) is a tropical fruit belonging to the Sapotaceae family, on which few studies have been done. The most common cultivars grown are Kalipatti, Chaatri, Dhola Diwani, Long, Bhuri/Bhuripatti, Jingar, Venjet, Plala, Kirtha Bharti, Dwarapudi, Jonnalas Round, Cricket Ball, Oval, Bangalore and Calcutta Round. Mature fruits are used in jams and provide a source. Mature fruits are used in jams and provide a source of raw material for the manufacture of industrial glucose, pectin and natural fruit jellies. Ripe Chikoo is eaten as dessert fruit and is also canned. Only the pulp is usually consumed, although the skin is richer nutritive value (Gopalan et al., 1990).

Each Chikoo fruit is a berry; round or oval, measures about 10 cm in diameter, and weigh about 150 g. A tree bears as many as 2000 fruits/year. Chikoo fruit has grey/brown, sandy, “kiwifruit like” outer surface but without the fuzziness. Unripe fruit possess white, hard, inedible pulp that secretes sticky latex containing toxic substance saponin. This milky flesh disappears and its white flesh turns brown as the fruit ripe. Once ripen, it becomes soft and acquires sweet taste and smooth or grainy texture with slight musky flavour. It contains 3-10 black, smooth, shiny bean shaped, inedible seeds, located at its centre.

Osmotic dehydration is the process of water removal by immersion of water containing cellular solids (fruits/vegetables) in a concentrated aqueous solution of sugar/salt. This results in intermediate moisture product with lower water activity. At low water activity, most of the chemical reactions which deteriorate the food, the growth and toxins production by microorganisms are ceased. Besides it improves the colour, flavour and texture and is less energy intensive process compared to air or vacuum drying process as no phase change takes place during the moisture removal from the substrate (Pokharkar, 2001). Osmotic dehydration is used as a pre- treatment for many processes used to improve nutritional, sensorial and functional properties of food without changing its integrity (D. Torrengiani, 1993).

Literature search indicated that, the study of osmotic dehydration of Chikoo and comparative study of its effect on the physiochemical properties of the dehydrated fruit is not available. The research work was carried out to analyze the same.
Materials and Methods

Sample and Solution Preparation

The test samples of fully ripened chikoo fruits were procured from local market of Allahabad for conducting the experiments. Homogenous fruits were selected considering the uniform size, ripeness, color and freshness. The samples were thoroughly washed under tap water to remove adhering impurities. Upper pericarp of chikoo fruit were carefully separated by hand peeling and slices were made using sharp edged stainless steel knife. Syrup of desired concentration (30, 40 and 50⁰ Brix) was prepared by dissolving required amount of sugar in distilled water.

Experimental setup and procedure for osmotic dehydration

Experiments were conducted at three concentration (30, 40 and 50⁰ Brix) and three temperature combinations (30, 40 and 50⁰ C). A sample of (chikoo fruit) 50 g was immersed in sugar syrup of 30⁰ B in 500 ml beakers and held at 30⁰C for 60 minutes in water bath at constant fruit to syrup ratio (1:5). Sample beaker was removed from water bath after 60 minutes. Samples were taken out and placed on blotting paper for 1 minute to remove excess solution on the surface and were weighed. They were then analyzed for their moisture content (Rangana, 2000). The samples were then microwave dried for further qualitative analysis was performed. The same process was repeated for other sugar syrup concentration and temperature. All the experiments were repeated thrice and results reported are from the average value of the replications.

Dehydration Ratio

Dehydration ratio calculated by taking the weights of sample before dehydration and after dehydration.

Rehydration Ratio

Sample was cooked in a beaker one part of dehydrated vegetable in 10 parts water for 20 minutes and then allowed it to cool at room temperature. The time taken for cooking was counted from boiling. Then beaker was filtered with No. 4 Whatman paper with care and inverting the container for 5 minutes. Cooled material was weighed.

Browning

2 gm of sample was homogenised by mixing in 5 mL acetic acid (1% v/v) using mortar pestle. The homogenized mixture was diluted to 20 mL with the acetic acid solution and filtered to get a clear solution which was used to measure browning using spectrophotometer at 420nm wavelength. The absorbance represented the extent of browning (Phisut et al., 2013).

Titratable Acidity

Titratable acidity was measured according to the procedure of Rangana (1986) with a slight modification. Ten grams of sample was homogenised in 30 mL of distilled water and then made up to 50mL. The homogenate was filtered and centrifuged at 5000 rpm for 10 min. The supernatant was titrated with 0.01 N NaOH using few drops of 1 % phenolphthalein indicator. The result was calculated as percent citric acid.

Vitamin C content

Ascorbic acid content was determined by 2,6-Dichlorophenol-Indophenol Visual Titration Method (Rangana 1986). 10 gm of sample was blended with 3% HPO₃ and made up to 100 mL with HPO₃. The solution was then filtered. An aliquot of 10 mL of the HPO₃ extract of sample was then titrated with standard dye to a pink end-point which persisted for at least 15 seconds.

Results and Discussion

The results of the study carried out on quality characteristics of osmotic dehydration have been presented in this section.

Dehydration ratio

Fig 1 shows that with increasing treatment concentration and temperature, dehydration ratio is increasing. At increased treatment concentration and temperature, the moisture loss from chikoo slices was more, therefore the weight of the samples reduced after dehydration process, hence a decrease in dehydration ratio was observed.
Fig 1: Effect of pretreatment on dehydration ratio

Rehydration ratio

At increased treatment temperature; the integrity of cells within the fruit is disturbed leading to decrease in water holding capacity, therefore significant decrease in rehydration ratio is observed (fig 2).

Fig 2: Effect of pretreatment on rehydration ratio

Browning index

From fig 3, it is evident that osmotic treatment at higher concentration and temperature has a decreasing browning effect on Chikoo slices. At higher treatment concentration and temperature, intake of sugar by Chikoo slices is more; therefore fruit gets surrounded by high amount of sugar that protects it from thermal damage during further conventional drying. Hence, there is decrease in browning of fruit slices.

Fig 3: Effect of pretreatment on Browning

Titratable acidity

Increasing the concentration of osmotic solution and treatment temperature resulted in decrease the acidity of the fruit slices (Fig 4) as acids present in fruit are lost with the outflow of water under osmotic pressure.

Fig 4: Effect of pretreatment on titratable acidity

Vitamin C content

A significant decrease in Vitamin C content was observed (Fig 5) with increasing treatment concentration and temperature attributed to water solubility and heat sensitive property of Vitamin C.

Fig 5: Effect of pretreatment on Vitamin C content

Conclusion

Syrup concentration and treatment temperature of the osmotic process has a definite effect on the osmotic dehydration of Chikoo samples. In osmotic dehydration, an increase of sugar concentration and temperature of osmosis increased water loss and solid gain. After one hour of dehydration, maximum moisture loss and solid gain is observed in the sample treated at highest concentration and temperature.

Osmotic dehydration followed by microwave drying has significant effect on the quality characteristics of Chikoo. Rehydration and dehydration ratio are directly dependent on the moisture loss percentage of the dehydrated fruit. The Chikoo samples with highest solid gain show least browning effect; this
may be attributed to high percentage of sugar content which shields the fruit cells against direct thermal destruction. Removal of water from Chikoo slices has a significant effect on increasing sugar to acid ratio of fruit; the one with highest sugar content is least acidic in nature. The Vitamin C content of Chikoo slices is decreased with increasing temperature because vitamin C is sensitive to heat. The overall acceptability of chikoo slices is much affected with the sugar gained in by the fruit as it improves flavour and taste. Osmotic treatment increases the shelf life of fruit and makes it available for consumption during off seasons.

References


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