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EFFECT OF SIZE REDUCTION ON OSMOTIC DEHYDRATION OF GUAVA

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ABSTRACT:

The effect of parameters such as varying time duration of osmosis and sugar syrup concentration at the time of osmotic dehydration of raw guava slices(5 mm thick) and cubes on mass transfer data such as water loss,solid gain and mass reduction were studied. Sucrose solution of 70^0B and 80^0B was employed as per osmotic dehydration process. After completion of osmotic dehydration process, the water loss from guava cubes and guava slicesof 70^0B is found as 28.45 to 44.41 and 23.49 to 36.14 per sent resp. and of 80^0B is found as 30.90 to 49.6 and 30.5 to 47.61per cent resp. Similarly,sugar gain and mass reduction was calculated for guava slices and guava cubes. It was observed that the mass reduction, water loss and sugar gain increases with increase in sugar syrup concentration and duration of osmosis.

KEYWORDS: Osmotic dehydration, size reduction, water loss, mass reduction, sugar gain, duration of osmosis

I. INTRODUCTION:

The Guava, botanically known as Psidiumguajava belonged to the family of Myrtaceae. Guava (PsidiumGuajava), is also called as the “poor man’s fruit” or“apple of the tropics”[1]. It was a popular tree fruit of the tropical and subtropical climates and was native to the tropical America stretching from Mexico to Peru. It had been adopted in India so well that it appeared to be an almost Indian fruit.Guava was considered to be one of the most exquisite and nutritionally valuable remunerative crops. The guava fruit and its juice are mostly consumed for its taste, nutritional values and flavor. In India after mango, banana and citrus, guava is the fourth most important commercial fruit for production. Guava was a fruitwhich was grown all over the country and also in kitchen gardening and near the wells and tube wellspremises and also grown on a commercial scale.For the production of guava fruit, nearly 0.15 million ha of land occupies with production of 1.80 million tons and productivity 12t/ha fruit per year in India. In India, guava is grown in Bihar, Andhra Pradesh, Uttar Pradesh, Gujarat, Maharashtra and Karnataka on large scale [2].

According to various shapes, sizes and other characteristics, the guava fruit of the different Varieties are extremely variable. The various varieties of guavafound as rounded, globular, ovoidor pear in shaped. The size of guava fruit is from 3 to 15 cm in length and has 4 or 5 sepal at the apex. The color of the guava fruit may be found asshades of green, yellow, or pink. The flesh may be of color white, pink, yellow, or red are observed. The small or hard seeds are present inside the flesh and outer layer of flesh is a finely granular pulp. Guava varieties have a taste from sweet to tart, all with musky flavor and odor. Guava fruits vary in the thickness of the fleshymesocarp, but in some varieties is extremely thin. Varieties differ widely in flavor and seediness, some are seedless. After ripening of guava, it becomes soft and juicy[3].

At ambient temperature, the shelf life of guava fruits is short. Generally, at the time of peak arrival the wastage of guava fruits is high due to its perishable nature; that’s why the spoilage occur primarily before it reaches the consumer due to microbial activity and an improper transportation, and also storage facilities. In tropical countries particularly in India observed that the postharvest losses of guava fruit are high. For reducing the huge loss of guava fruit one effectivemethod is applywhichconverts guava into various commercial guava products as it can be utilized in many ways for making jelly, jam, paste, juice, puree, beverage base, syrup and wine. The guava fruit is a source of pectin also which is rich in minerals like phosphorus, calcium, iron and other sources like vitamins such as niacin, pathogenic acid, thiamine, riboflavin, vitamin A, vitamin C, and dietary fiber which is in high amount. Hence, there is a worldwide growing demand for guava as a healthy and nutritive fruit [4]. Guava is available in all seasons except summer season. The guava crop didn’t require huge care but it gives high quality product. The guava production is not a costly production because the requirements for fertilizer, irrigation and plant protection are not more as compare to other fruit production. Also it contains higher nutritional value.

Therefore, guava fruit said as an ideal fruit for the nutritional fact[5].

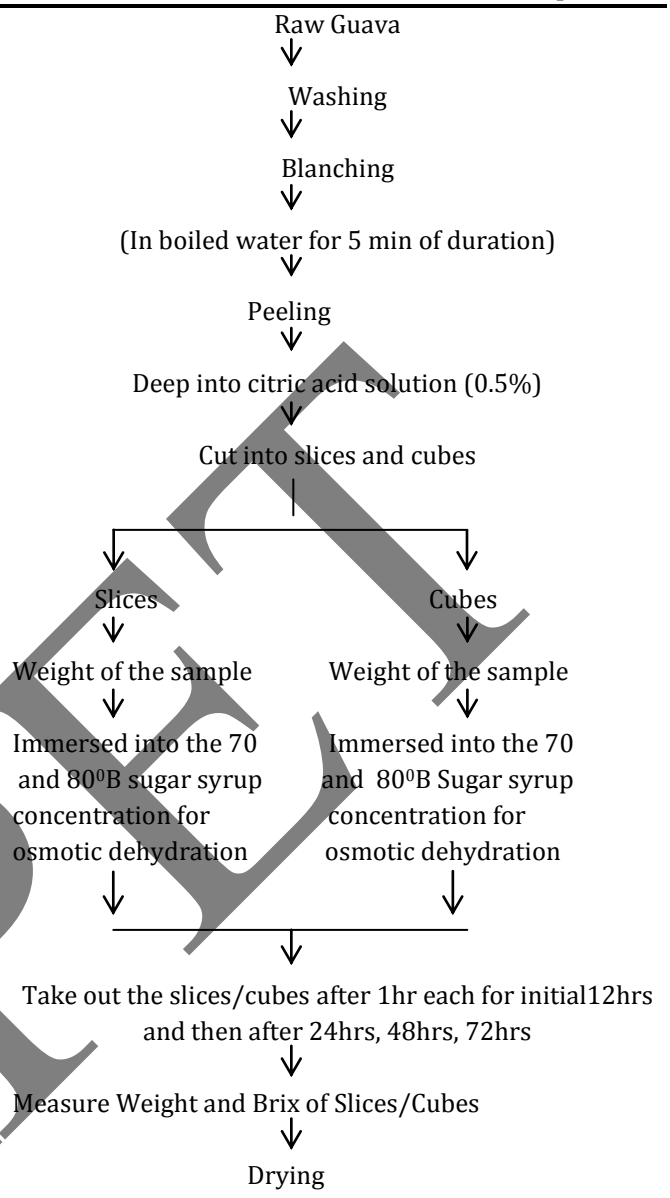
Fruits and vegetables drying may cause the changes in flavor and nutritional components if exposed to high temperatures. The reduction of aroma and volatiles, pigments and vitamins oxidation, and case-hardening and woody texture, slow or incomplete rehydration and considerable shrinkage during drying occurs. The drying process should consume less fossil fuels and electricity, and it should be also maintained the quality of product. The process of osmotic dehydration has been motivated as economic factor and have an applications for the improvement of quality, color, taste, etc. This process gives wide application in food industry. In recent years as a pretreatment for the removal of water gives attention towards osmotic dehydration process which reduces energy consumption and heat damage[6][7][8][9].

Osmotic dehydration process has an important complementary treatment and food preservation technique in the processing of dehydrated foods [10]. In this dynamic process, water and acid are removed fast at start and then move slowly, while sugar mass penetration is very slight at start but increases with the duration of osmosis. Therefore, the characteristics of the product can be increases by increasing sugar syrup concentration, concentration of osmosis solution, duration of osmosis, etc. to make osmotic dehydration process faster [11]. Although osmotic dehydration process will not give a product of completely low moisture content after this process product needs to be further dried, through air, vacuum or freeze drying [12].

II. MATERIALS AND METHOD:

A. PREPARATION OF SAMPLE:

Raw guava was thoroughly washed by using water and the surface moisture was removed using blotting paper. Then blanched this raw guava by using boiled water for a 5 min of duration and peeled it. They were sliced (5±0.5mm thick) and cut into cubes manually using knife of stainless steel and deep in 0.5 % citric acid solution for 2 min. Sucrose solution used as an osmosis agent, the sugar solution of concentration 70^0 Brix and 80^0Brixwas prepared by adding the required quantity of sugar in drinking water. Osmotic dehydration of sliced/cube guavas were conducted with two different sugar syrup concentrations 70^0 Brix and 80^0Brix. Cut slices/cubes immersed into required brix sugar syrup for osmotic dehydration.Take out the slices/cubes after 1hr each for initial 6 hrs. and then after 24hrs, 48hrs, 72hrs and measure weight and brix of slices and cubes.



B. OSMOTIC DEHYDRATION:

Osmotic dehydration, also called a "dewatering impregnation soaking process" is a water removal process that includes the soaking of food sample in hypertonic salt or sugar syrup or in a combined solution, to reduce the water content while increasing the soluble solid content [13]. The sample of raw food material is placed in concentrated solutions such as salt solution or sugar syrup solution of soluble solids with higher osmotic pressure and water activity is lower. This results in three different types of counter mass transport phenomenon in osmotic dehydration process.

1. At the start, water diffuses out product to the solution with faster rate initially and then slows down.
2. A solute which transfer from the salt or sugar syrup solution to the product; this is possible to introduce the higher amount of preservative agent, any solute

or nutritional interest, or a sensory quality improvement of the product.

3. Leaving out of products own solutes (sugar, organic acids, minerals, vitamins, etc.), which is negligibly small when compares with the other two types of transfer [14].

C. CALCULATION FOR WATER LOSS, SUGAR GAIN AND MASS REDUCTION:

In the process of osmotic dehydration, calculations of water loss, sugar gain and mass reduction was carried out which is shown in following equations respectively [15].

WATER LOSS (WL):

The water loss is defined as the ratio of the net water loss of the guava fruit to the initial weight of guava fruit which is calculated as,

$$WL = \frac{W_i X_i - W_\theta X_\theta}{W_i}$$

SUGAR GAIN (SG):

Sugar gain is defined as the ratio of the net uptake of sugar by the slices or cubes tothe initial weight of the guava which is calculated as,

$$SL = \frac{W_\theta (1-X_\theta) - W_i (1-X_i)}{W_i} \times 100$$

MASS REDUCTION (MR):

Mass reduction (MR) is defined as the ratio of the net mass reduction of the guava fruit to the initial weight of guava. It is also defined as the difference between water loss and solid gain which is calculated as,

$$MR = \frac{W_i - W_\theta}{W_i}$$

Where,

WL = Water loss from guava slices/cubes in g per 100 g mass guava slices/cubes.
SG = Solid gain by guava slices/cubes in g per 100 g mass of guava slices/cubes. MR=Mass reduction of guava slices/cubes in g per 100 g mass of guava slices/cubes.W_i = Initial mass of guava slices/cubes in g.W_θ= Weight of guava slices/cubes in g at time θ.X_θ= water content present as a function of guava siles/cubes at time θ.X_i= Initial water content present as a function of guava slices/cubes

III. RESULTS AND DISCUSION:

A. EFFECT ON WATER LOSS BY VARYING SUGAR SYRUP CONCENTRATIONS:

The effect of concentration of sugar syrup on water loss has been illustrated in Fig. The water loss was found as of 28.45 to 44.41 per cent from cubes and 23.49 to 36.14 per cent from slices for 70ºB, respectively when duration of osmotic dehydration varies from 0 to 72 hrs. Also for 80ºB, the water loss was found as 31 to 49.6 per cent from cubes, respectively 30 to 47.61 per cent from slices. It was obtained that a lower sugar concentration condition (70ºB) resulted in a lower water loss and a highersugar concentration condition (80ºB) resulted in a higher water loss.The result found that the higher percentage of water loss from osmotic dehydrated guava cubes for 80ºB. This shows that the water loss can be increased by increasing the sugar syrup concentration. That means, water loss increases with increase in sugar syrup concentration and differ in different sizes of guava due to increased osmotic pressure in the sugar syrup at high concentrations, which increased the driving force available for water transport.

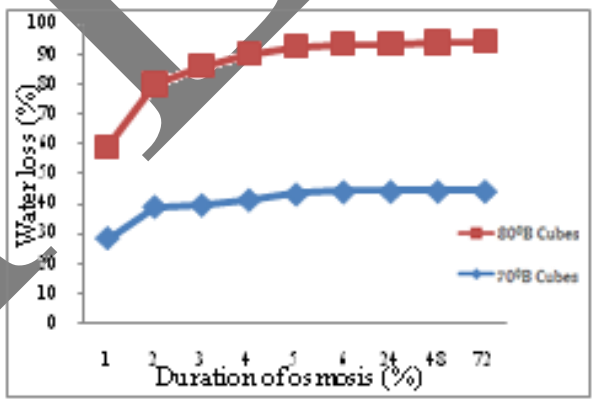


Figure1-Effect on water loss by varyingsugar syrup concentrations with Cubes.

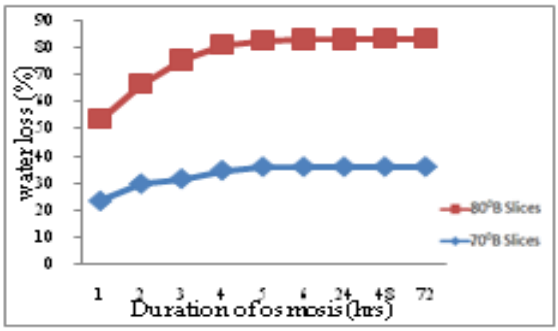


Figure 2.-Effect on water loss by varying sugar syrup concentrations with Slices.

B. EFFECT ON SUGAR GAINBY VARYING SUGAR SYRUP CONCENTRATIONS:

The effect of concentrations of sugar syrup on sugar gain has been illustrated in Fig. The sugar gain of 7.35 to 39 per cent was found from cubes and 7.69 to 36 per cent from slices at 70ºB when duration of osmotic

dehydration varies from 0 to 72hrs. Also for 80ºBrix, the sugar gain was found to be 8.21 to 49 per cent from cubes and 7.91 to 34.01 per cent from slices. It was obtained that a lower concentration condition (70ºB) resulted in a lower sugar gain and a higher concentration condition (80ºB) resulted in a higher sugar gain. This shows that sugar gain in raw guava which is increases by increasing the sugar syrup concentration.

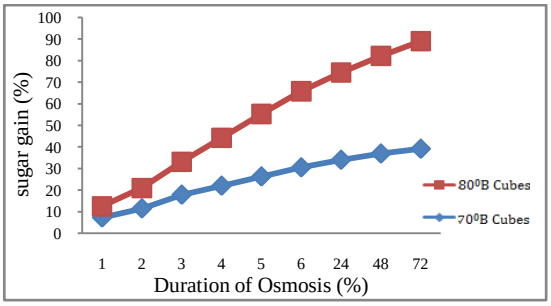


Figure 3-Effect on sugar gain by varying sugar syrup concentration with Cubes.

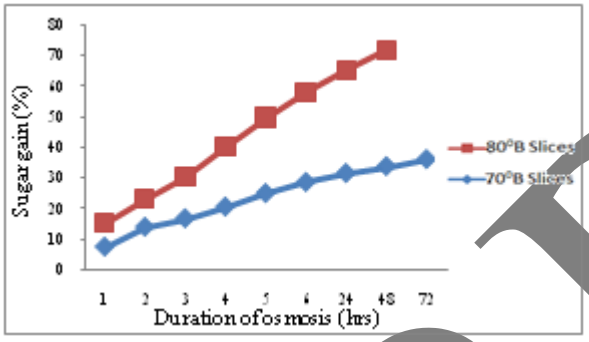


Figure 4- Effect on sugar gain by varying sugar syrup concentrations with slices.

C. EFFECT ON MASS REDUCTION BYVARYING SUGAR SYRUP CONCENTRATION:

The effect of concentrations of sugar syrup on mass reduction has been illustrated in Figs. The mass reduction was found to be 21.10 to 42 per cent from cubes and 15.80 to 34 per cent from slices at 70ºB, respectively when duration of osmotic dehydration of raw guava varies from 0 to 72 hrs. Also for 80ºB, the mass reduction was found to be 25.70 to 45 per cent from cubes and22.60 to 44 per cent from slices, respectively. It was observed that a lower concentration condition

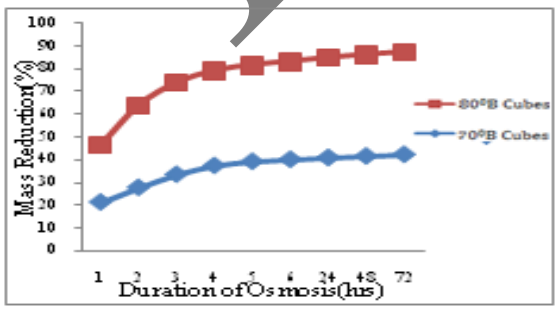


Figure 5-Effect on mass reduction by varying sugar syrup concentrations with cubes.

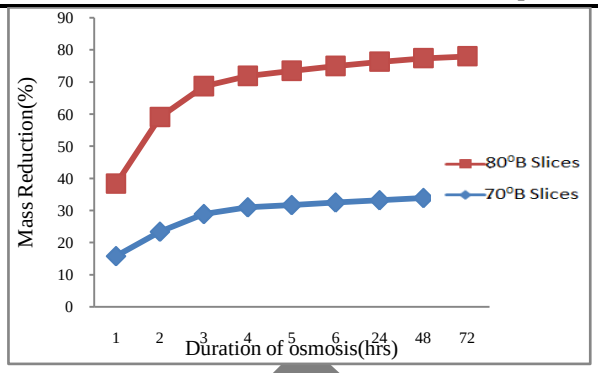


Figure 6- Effect on mass reduction by varying sugar syrup concentrations with slices.

(70ºB) resulted in a lower mass reduction and a higher concentration condition (80ºB) resulted in a higher mass reduction. This shows that mass reduction can be increased by either increasing the sugar syrup concentration.

D. SENSORY EVALUATION:

Initially different combination and different sizes of osmotic dehydrated guava was prepared, by varying the concentrations of guava as 70⁰B and 80⁰B respectively. Sensory evaluation was done by using 9.0 headonicscale by 10 semi trained panel members. From the evaluations the 70⁰B osmotic dehydrated guava cubes and slices score minimum and was dislike because of hardy texture and off color of guava. Whereas 80⁰B osmotic dehydrated guava cubes was accepted strongly than 80⁰B osmotic dehydrated guava slices with respect to all the sensory parameters by the panelist. Sensory analysis is done by panel the 80⁰B osmotic dehydrated guava cubes is consider as best one as shown in below Table.

Table 1- Sensory analysis of osmotic dehydrated guava slices and cubes

Characteristics	Trails			
	70⁰B Cubes	80⁰B Cubes	70⁰B Slices	80⁰B Slices
Appearance	6.5±0.12	7±0.5	5.9±0.1	6.6±0.15
Color	6.4±0.4	6.7±0.5	5.9±0	6.8±0.3
Texture	6.5±0.6	6.8±0.31	6.1±0.15	6.5±0.25
Flavour	6.9±0.5	6.6±0.35	6.12±0.1	6.52±0.35
Taste	6.9±0.2	6.7±0.2	5.9±0	6.6±0.2
After Taste	6.9±0.1	6.9±0.3	6.3±0.15	6.56±0.3
Overall Acceptability	6.8±0.1	6.9±0.4	6.1±0.2	6.72±0.5

E. NUTRITIVE VALUES:

According to sensory evaluation nutritive values of 80⁰B osmotic dehydrated guava cubes was evaluated.

Table 2- Nutritive values

Constituents	80^0B guava cubes(per 100 g)
Moisture	7.8 %
Ash	0.2 %
Ascorbic Acid	10.8 mg
Fat	0.26 %
Crude Fiber	3 %
Phosphorus	0.1 mg
Iron	0.175 mg
Calcium	2.24 mg

CONCLUSION:

The effect of parameters such as varying time durationof osmosis and sugar syrup concentration at the time ofosmotic dehydration of raw guava slices (5mm thick) and cubes on mass transfer data such as water loss, solid gain and mass reduction were studied. Sucrose solution of 70^0B and 80^0B was employed as per osmotic dehydration process. It was observed that the mass reduction, water loss and sugar gain increased with increase of sugar syrup concentration and duration of osmosis. The results obtained that an osmotic dehydration process is faster in guava cubes as compare to guava slices with sucrose concentration. Furthermore, according to sensory evaluation, after the osmotic dehydration process guava samples of having higher sugar syrup concentration which is more softer than lower sugar syrup concentration. By varying sugar syrup concentration and duration of osmosis causes softer tissue of osmotic dehydrated product compared with the fresh raw guava.

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