"OSMOTIC DEHYDRATION OF PINEAPPLE"

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ABSTRACT

Pineapple *(Ananas comosus)* is a tropical fruit. It is native to Central and South America. It is grown on large scale in India and now India is the second largest producer of fruits after Brazil.

Effects of osmotic dehydration on mass transfer and weight reduction during osmotic dehydration of pineapple cubes were investigated in order to determine the usefulness of this technique as pretreatment for further drying of pineapple cubes. Water loss, weight reduction and solids gain increased with treatment time. The maximum mass transfer during osmotic dehydration of pineapple cubes was in the sample treated with 60° brix while minimum mass transfer was observed in sample treated with 40° brix. In the oven drying the pineapple cubes dipped in 60^0 brix syrup showed maximum weight reduction up to 60 grams. The best sample found after organoleptic evaluation was the sample treated with 60° brix solution which scored highest points for flavor, texture, mouth feel and color.

Keywords: Pineapple cube, Osmotic dehydration, solid gain, moisture content.

1. INTRODUCTION

Pineapple is a tropical fruit grown in the tropical and sub-tropical regions. It is native to Central and South America. It is grown on large scale in India and now India is the second largest producer of fruits after Brazil. Pineapple is largely consumed around the world as canned pineapple slices, chunk and dice, pineapple juice, fruit salads, sugar syrup, alcohol, citric acid, pineapple chips and pineapple puree. It mainly contains water, carbohydrates, sugars, vitamins A, C and carotene.

The process of osmosis can be used to remove water from a dilute solution contained within a semi- permeable membrane by surrounding the membrane with a more concentrated solution. Osmotic dehydration can remove 50% of the water from fresh ripe fruits. The final drying of these osmotic dehydrated fruits by vacuum drying provides a product which has good quality, attributes with respect to appearance, taste, flavor and colour as compared to sun drying.

Osmotic dehydration is considered as a pre-treatment for pineapple with the final aim of obtaining high quality dried fruit products. Up to 40% of agricultural produce is wasted in developing countries, mainly due to the lack of storage and processing facilities, as well as to a limited knowledge of processing technologies (Brahim, 2000). Osmotic dehydration is widely used to remove part of the water content of fruit to obtain a product of intermediate moisture or as a pre-treatment before further processing (Lenart, 1996; Torreggiani, 2004). Rehman (1990) studied the osmotic dehydration of pineapple. They pointed out that water loss and solid gain (Sucrose diffusion) increased linearly with increased in temperature. The solid gain becomes nearly constant above 60° brix.

2. MATERIALS AND METHODS

2.1 Preparation of osmotically dehydrated pineapple cubes

The dehydrated pineapple cubes were prepared by the method as given in flow chart (Fig. 1) proposed by Ramamurthy (1998).

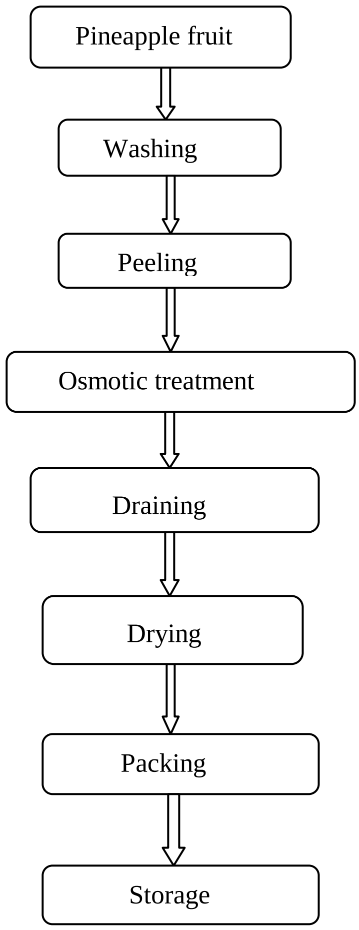

Fig 1 Flow chart for preparation of osmotically dehydrated pineapple cubes

2.2 Process of Osmotic Dehydration

Osmotic dehydration was carried out by placing the fresh pineapple cubes in sugar syrup with varying concentrations of 40, 50, 60 ^{0}brix. The osmosis was carried out at room temperature. The dipping process was carried out for 4 hours to calculate solid gain (SG) %, water loss (WL) and weight reduction (WR). Mass transfer during syruping (at room temperatures) to predict the water loss and solid gain during osmotic dehydration the phenomenon of mass transfer was studied. The losses in weight of sample during drying were recorded at half hourly interval during course of study.

2.3 Drying

Osmotically dehydrated pineapple cubes were dried in Hot air oven at 70°C temperature and at the constant weight.

2.4 Organoleptic evaluation of osmotically dried pineapple cubes

The samples were evaluated for color and appearance, flavor, texture, taste and overall acceptability by a panel of semi trained judges on the basis of 9 point hedonic scale (Ranganna, 2004). The average of all the sensory parameters was recorded. The obtain results were statistically analyzed by analysis of variance (ANOVA).

3. RESULTS AND DISCUSSION

3.1 Initial Physico-chemical properties of pineapple:

The initial data on physicochemical parameter of pineapple includes physical parameter like shape, color, diameter, weight and chemical parameters like moisture, TSS as reported in Table 1.

Table 1 Physicochemical properties of fresh pineapple

Sr. no	Characteristics	Values
1	Average weight(grams)	1241
2	Pulp (%)	66
3	Peel (%)	44
4	Core (%)	15
5	Waste index (%)	59
6	Total soluble solids(°Brix)	12
7	Moisture content (%)	87
8	Vitamin C (%) (mg)	38.2

* A_1, A_2, A_3 – Samples

3.2 Effect of different concentration of sugar and syrup temperature on mass transfer

Effect of different concentrations of sugar and temperature of syrup on mass transfer as a function of time was studied during standardization process. The results obtained are shown graphically in Fig 1 to Fig 3. The weight was continuously reduced upto 3 hours of dipping and then slightly decreased for all the concentrations. Initially the rate of mass transfer was higher but it was reduced gradually as time progressed. Maximum mass transfer was found in case of sample treated with 60° Brix at room temperature of sugar syrup while minimum mass transfer was observed in sample treated with 40° Brix and 50° Brix sugar syrup. These are significantly hampered as compared to sample treated with 40° Brix & 50° brix.

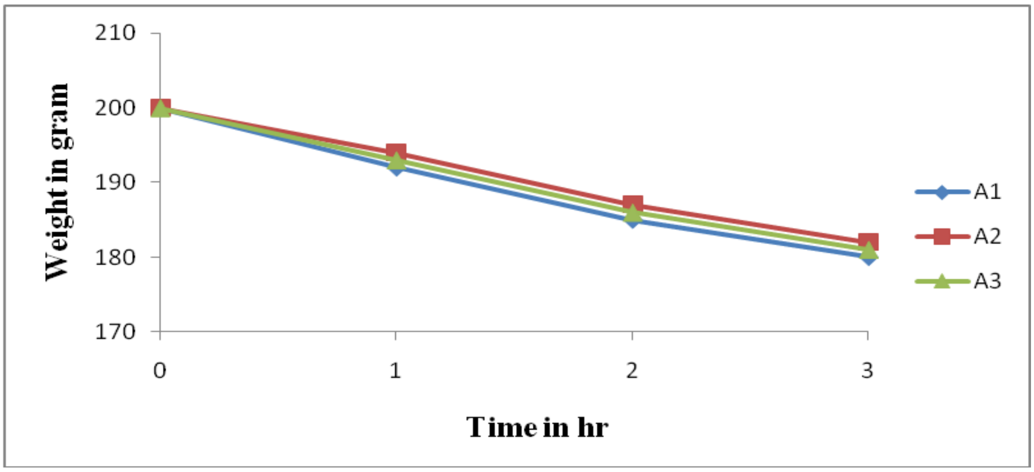

Fig. 1 Effect of sugar syrup concentration 40° brix on mass transfer at room temperature.

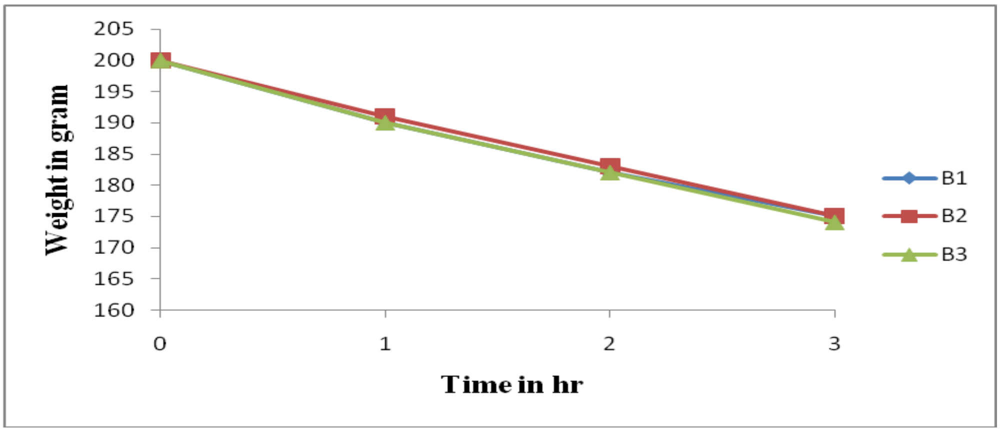

Fig. 2 Effect of sugar syrup concentration 50° brix on mass transfer at room Temperature

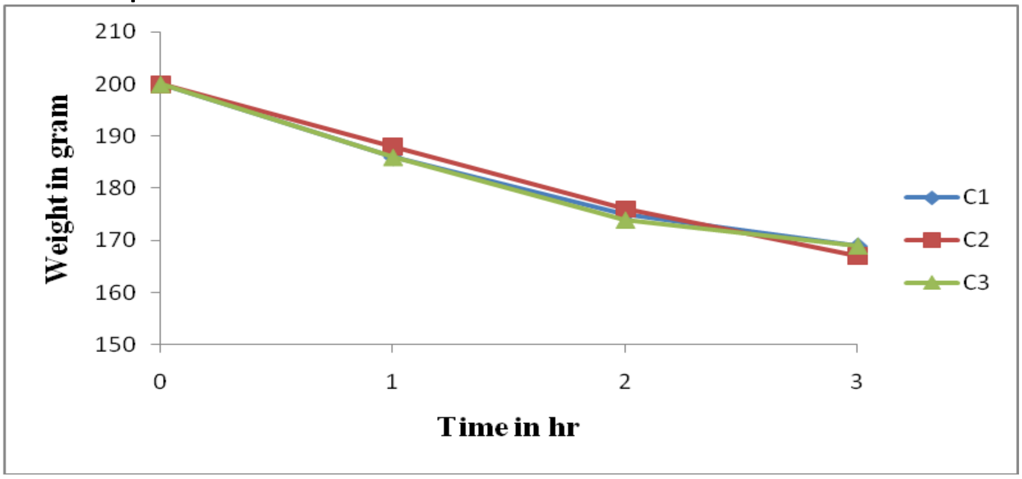

Fig. 3 Effect of sugar syrup concentration 60° brix on mass transfer at room Temperature

3.3 Effect of drying on weight reduction

Oven drying was performed at 70°C. Initially the rate of drying and reduction in weight was maximum but it was reduced gradually as time increased. The pineapple cubes dipped in 60° brix syrup had maximum weight reduction up to 60 grams whereas 50° brix had 63 grams.

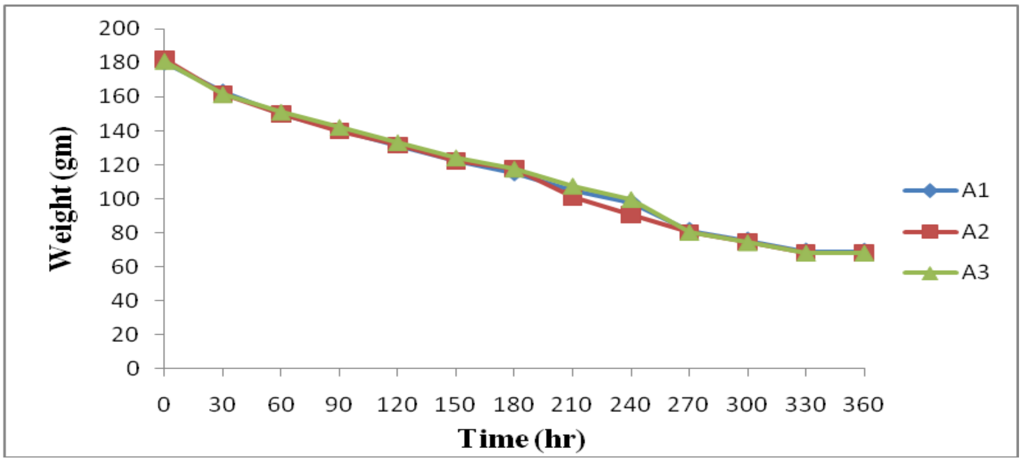

Fig. 4 Drying profile of tray dried pineapple cubes at 40° Brix

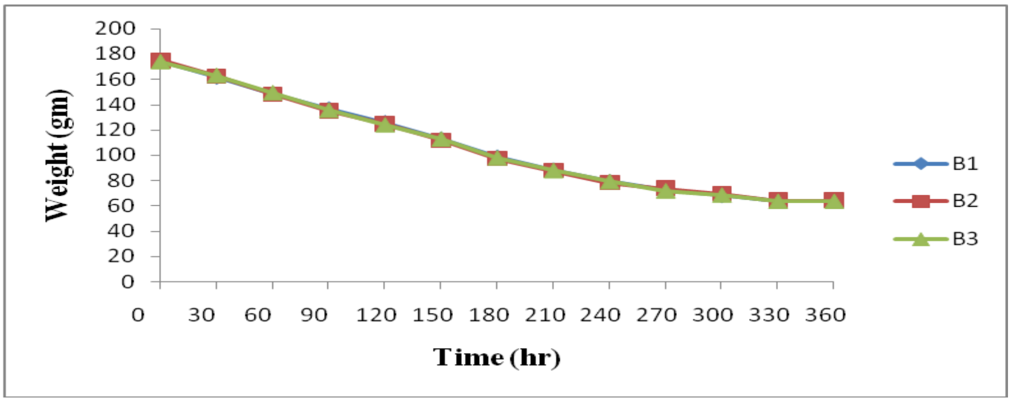

Fig. 5 Drying profile of tray dried pineapple cubes at 50° Brix

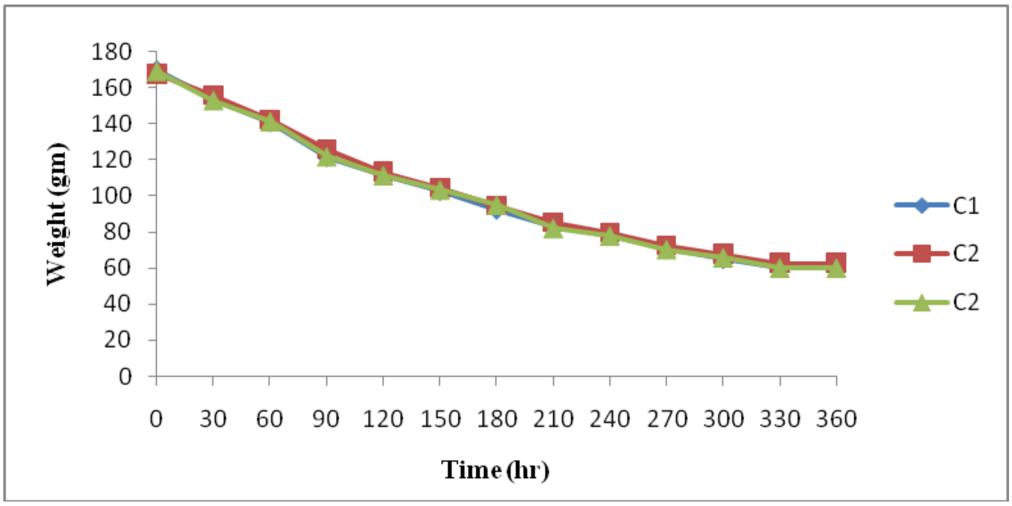

Fig. 6 Drying profile of tray dried pineapple cubes at 60° Brix

The results obtained regarding the effect of sugar syrup concentration on moisture content are tabulated in Table 2. The moisture content of sample was determined after removing from sugar syrup. The moisture content was found to be decreased when concentration of syrup increased. 60° brix sample showed the maximum reduction in moisture content.

From Table 3 it is seen that the moisture content percentage is lower in 60° Brix sample as compared to others. The ascorbic acid content decreased gradually as the concentration increased possibly due to oxidation of ascorbic acid to dehydro-ascorbic acid

Table 2 Effect of sugar syrup concentration on moisture content

Concentration of sugar solution	Sample	Moisture content (%)
40° Brix	A_1	70.60
	A_2	72.34
	A_3	72.91
50°Brix	B_1	68.31
	B_2	65.19
	B_3	68.20
60° Brix	C_1	64.15
	C_2	62.10
	C_3	64.15

Table 3 Different parameters taken after drying of pineapple cubes.

Concentration of sugar solution	Sample	Moisture content (%)	TSS (° Brix)	Acidity (mg-KOH/gm)	Vitamin C (mg /100gm)
40° Brix	A_1	12.2	12.4	3.2	171.46
	A_2	11.5	11.2	3	173.50
	A_3	12.4	13.4	2.8	168.12
50°Brix	B_1	9.8	13.2	2.9	162.04
	B_2	11.3	12.8	3.2	164.23
	B_3	8.6	11.5	1.9	160.34
60° Brix	C_1	7.3	12.2	2.2	115.74
	C_2	8.25	14.5	1.8	125.70
	C_3	8.4	13.7	2.4	112.10

3.4 Organoleptic evaluation

Osmotically dehydrated pineapple cubes were analyzed using 9 point scale for various quality attributes and results are summarized in Table 4. It is found that the sample dipped in 60° Brix solution and dried is significantly superior to other samples in terms of color. The sample dipped in 60° Brix solution dried got a good texture and 60° Brix solution, dried got inferior texture. The taste of sample dipped in 50° Brix solution and dried has good taste over other samples.

Lot No.	Samples	Parameters					
		Color	Taste	Texture	Flavor	Mouth feel	Overall Acceptability
Lot 1	A_1	7.7	7.5	7.7	7.4	7.7	7.6
	A_2	7	6.9	7.5	7.6	7.1	7.22
	A_3	7.3	7.2	7.3	7.3	7.4	7.3
Lot 2	B_1	7.5	7.8	8.2	8.5	7.6	7.92
	B_2	7.8	7.9	8.4	8.7	7.8	8.12
	B_3	7.7	7.8	8.1	8.5	7.6	7.94
Lot 3	C_1	8.2	7.9	7.9	8.3	8.5	8.16
	C_2	8.4	9	7.8	8.5	8	8.34
	C_3	8.2	8	8.6	7.9	9	8.34
Mean		**7.76**	**7.78**	**7.94**	**8.08**	**7.86**	**7.88**
STDEV		**0.46**	**0.59**	**0.42**	**0.56**	**0.58**	**0.42**

Table 4 Effect of concentration on sensory quality of pineapple

*Lot 1- 40° Brix A_1, A_2 & A_3- Replication of 40° Brix
Lot 1- 50° Brix B_1, B_2 & B_3- Replication of 50° Brix
Lot 1- 60° Brix C_1, C_2 & C_3- Replication of 60° Brix

ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Rows	8.49	8	1.07	11.34	3.28E-08	2.18
Columns	0.63	5	0.13	1.34	0.27	2.45
Error	3.74	40	0.09			
Total	**12.86**	**53**				

Table 5 Statistical analysis of sensory data

It has been observed from data that 60° Brix solution dried sample has good flavor and mouth feel. It has been observed that overall acceptability of sample dipped in 60° Brix solution is significant over sample dipped in 40° Brix, 50° Brix solution. The sample dipped in 60° Brix solution has got maximum score for acceptability i.e. 8.34, thus the sugar concentration 60° Brix gave good organoleptic score as compared to other concentrations.

From Table 5 it was found that *F actual* is greater than *F critical*, hence it is significant for provided data to the analysis. It means that the provided values are dependent upon each other.

4. CONCLUSION

The maximum mass transfer was found in sample treated with 60° brix while minimum mass transfer was observed in sample treated with 40° brix and 50° brix sugar syrup. In the oven drying the pineapple cubes dipped in 60° brix syrup showed maximum weight reduction up to 60 grams where as 50° brix up to 63 grams. From sensory evaluation we conclude that the sample dipped in 60° brix solution dried sample has good flavor, texture, mouth feel and color. From statistical analysis we found that *F actual* is greater than *F critical*, hence it is significantly affected for provided data to the analysis. It means that the provided values of sensory evaluation are dependent upon each other.

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