OSMOTIC DEHYDRATION OF UNSKINNED ORANGE CARPEL

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Abstract - *Osmotic dehydration is gaining importance as a better method of drying of fruits. There are several advantages associated with osmotic dehydration that include, lower drying temperature, lower energy requirement & better product quality with retention of aroma, texture & valuable ingredients. The rate of dehydration under osmotic conditions is affected by the parameters, osmotic medium, concentration of osmotic solution, temperature & time. The objective of the present work is to study the effect of time, temperature and concentration of osmotic sugar solution on the weight reduction during dehydration of orange carpel. Based on the observations, results and discussion, it can be concluded that, orange carpel can be partially dewatered by osmotic dehydration using osmotic sugar solution. The % weight reduction obtained varied from 9 to 44 depending upon the operating parameters like sugar solution concentration, temperature and duration of osmosis. It is observed that the most favoured operating parameters are, sugar solution concentration of 50% & temperature of 45°C with time duration of osmosis of 240 minutes. The present work is successful in addressing the dehydration of orange carpel & highlighted the potential in osmotic dehydration. The work is representative & more experimental runs should be conducted for varying combinations of the parameters to establish the claim.*

Key Words: Osmotic dehydration, orange carpel, % weight reduction, drying of oranges.

1. INTRODUCTION:-

India is one of the largest Fruit & Vegetables producing country in the world. However, it is estimated that about 25% of Fruit & Vegetables produced is spoiled due to lack of storage, transportation, and inadequate processing facilities. Drying is viewed as important operation in removal of moisture from materials so as to facilitate ease in handling, storage & processing. Osmotic dehydration is gaining importance as a better method of drying of fruits. There are several advantages associated with osmotic dehydration that include, lower drying temp, lower energy requirement & better product quality with retention of aroma, texture & valuable ingredients. The medium in osmotic dehydration involves aqueous salt or sugar solution instead of air [1].

Orange fruit consist of several carpel segments covered by the peel. Each carpel segment consists of several juicy sacs covered by skin. Juice is filled inside the sacs covered by cell membrane. Orange juice thus can be extracted from the fruit by removal of the peel, separating the carpel segment & further removing the skin and crushing the juicy sacs. The drying of orange fruit is a difficult task due to the present of outer peel, intermediate skin of each carpel segment and cell membrane of each juicy sacs. The rate of dehydration under osmotic conditions is affected by the parameters, osmotic medium, concentration of osmotic solution, temperature & time. Present work is aimed at osmotic dehydration of carpel, the most valuable ingredient of oranges. After removing the skin, the juicy sacs taken together are process for dehydration using osmotic solution. And study of effect of these parameters in osmotic dehydration is carried out.

There are several publication related to osmotic dehydration of vegetables & fruits, however very little could be cited related to orange carpel. Optimization of osmotic dehydration of orange pieces (*Valencia late*) in sugar solution using response surface methodology is reported in literature where in the effect of various parameters such as temperature, time & concentration of sugar solution is studied for drying of orange slices [2]. Similarly the effect of these parameters have been studied in osmotic dehydration of beet root and banana slices [3, 4]

2. PRESENT WORK:-

Osmotic dehydration can be viewed as an alternative method for drying of food materials with advantages of retention of gloss, texture & colour of dried products. The objective of the present work is to study the effect of time, temperature and concentration of osmotic solution on the weight reduction for the process of osmotic dehydration of orange carpel [5].

2.1 Materials:-

Fresh oranges purchased locally, were washed, peeled off, separated into slices. The skin is removed. The osmotic solution is prepared by dissolving weighed quantity of commercial grade sugar in proper amount of distilled water.

2.2 Experimental procedure

The details of process steps photographic procedure is given in fig 1.Orange carpel were weighed & placed into a glass vessel containing sugar solution of known concentration. The glass vessel was put on heating mantle to maintain constant temperature condition. The carpel were removed after particular time, gently blotted with adsorbent paper & weighed. The details of observation recorded are as given in table 1.

2.3 Photographic Representation

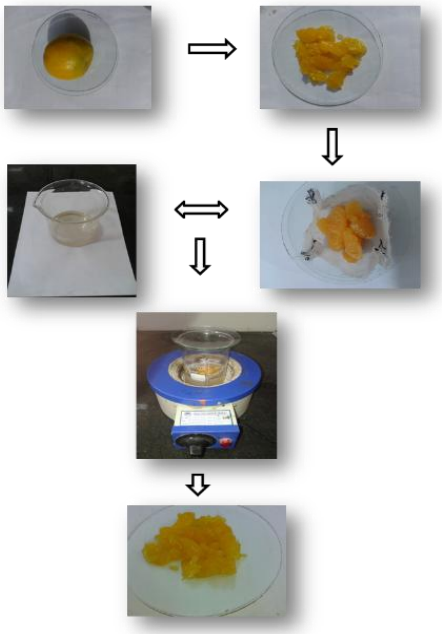

Figure 1: Photographic Procedure

The % weight reduction is calculated for each observation using following expressions.

% Weight loss = (W0 – Wt) / W_0* 100;

Where,

W0= Initial weight at time t=0;

Wt = Final weight at time t.

The details are as given in table 2

Observation Table

Sr. No.	Temp. (ºC)	Concentration (%)	Time (hr)	Initial wt. of orange carpel (gm)	Final wt. of orange carpel (gm)
1	27	20	1 2 4	50 50 50	45.62 45.22 44.2
		30	1 2 4	50 50 50	45.32 44.395 43.05
		50	1 2 4	50 50 50	44.26 42.94 40.775
2	35	20	1 2 4	50 50 50	42.57 40.675 36.795
		30	1 2 4	50 50 50	40.815 38.485 35.305
		50	1 2 3	50 50 50	37.945 35.99 32.68
3	45	20	1 2 4	50 50 50	39.07 37.455 33.79
		30	1 2 4	50 50 50	37.62 35.965 32.185
		50	1 2 4	50 50 50	35.25 32.24 28.03

Table 1: Details of osmotic dehydration parameters

Sr. No.	Time (hr)	Conc.	% Reduction in Wt.		
			27°C	35°C	45°C
1	1	20%	8.76	14.86	21.86
	2		9.56	19.52	25.09
	4		11.6	24.85	32.42
2	1	30%	9.36	18.37	24.76
	2		11.21	23.03	28.07
	4		13.9	29.39	35.63
3	1	40%	10.89	20.4	29.5
	2		12.3	25.4	32.4
	4		16.84	34.64	43.94

Table 2: Details of % weight reduction

3. RESULT AND DISCUSSION:-

3.1 Reduction in wt. at varying temperature & concentration:

Similarly figure numbers 2, 3 & 4 show the graphs plotted between reduction in weight as a function of time for varying temperature conditions for 20%, 30% & 50% sugar solution. It can be seen that, the weight reduction is linear with time & concentration.

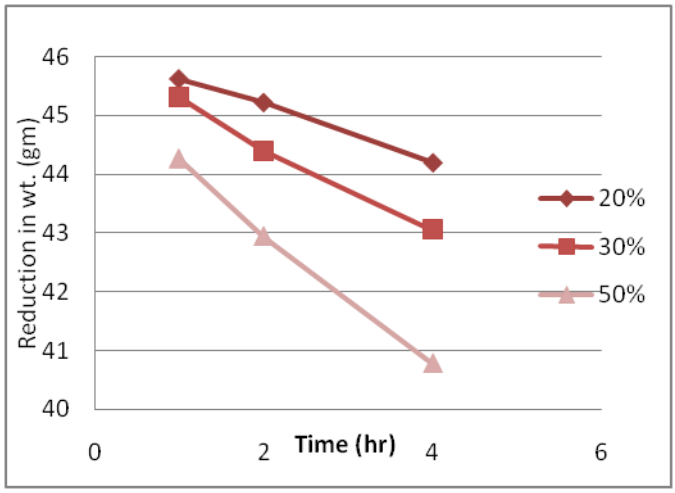

Figure 2: Reduction in wt. at 27° C and 20%, 30% & 50% concentration

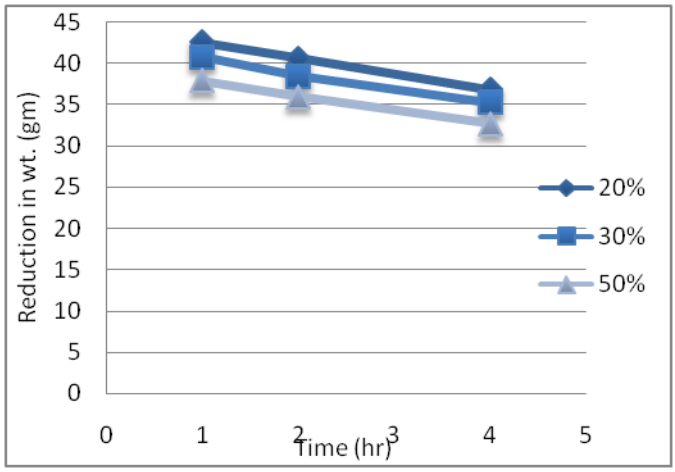

Figure 3: Reduction in wt. at 35° C and 20%, 30% & 50% concentration

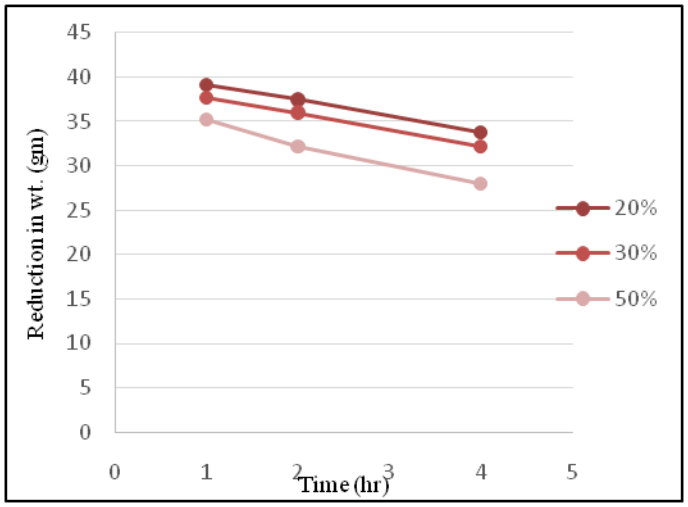

Figure 4: Reduction in wt. at 35° C and 20%, 30% & 50% concentration

3.2 Effect of sugar concentration on % weight reduction with time:

The figure numbers 5, 6 & 7 show the graphs plotted between % weight reduction of orange carpel as a function of time for varying sugar concentration at 27°, 35° & 45°C respectively. It can be seen that, the weight of orange carpel decreases linearly with time & with varying concentration of sugar solution.

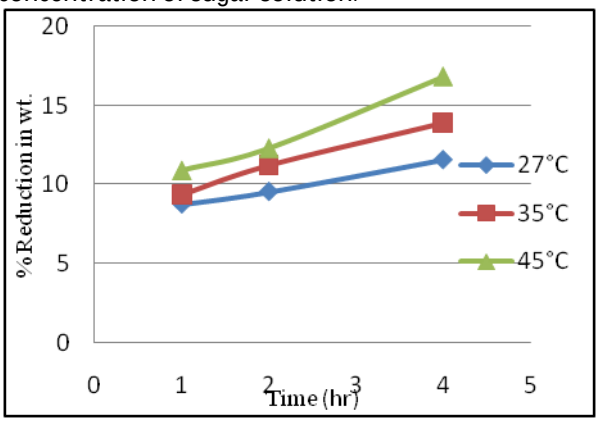

Figure 5: Effect of 20% sugar solution on % weight reduction with time

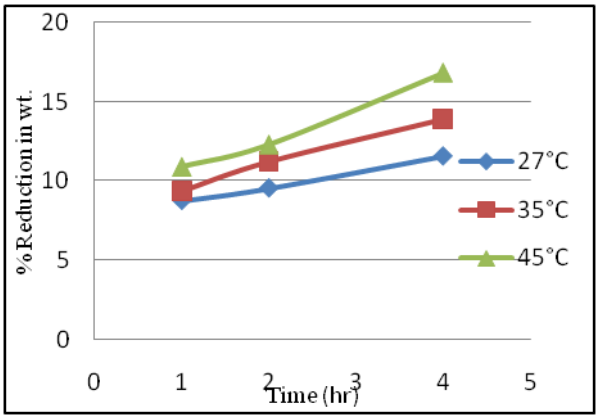

Figure 6: Effect of 30% sugar solution on % weight reduction with time

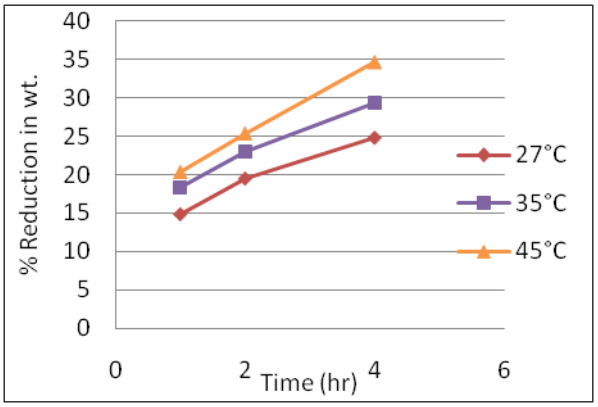

Figure 7: Effect of 50% sugar solution on % weight reduction with time

3.3 Effect of concentration of osmotic solution on % weight reduction:

The figure 8, 9 & 10 show the graphs plotted between % reduction in weight as a function of time for varying concentration of sugar solution. It can be seen from these graphs that the % reduction in weight varies between 9-44 % depending upon the conditions of temperature, time & concentration of sugar solution. It is also observed that, the reduction varies linearly with temperature & best results are obtain at 45°C.

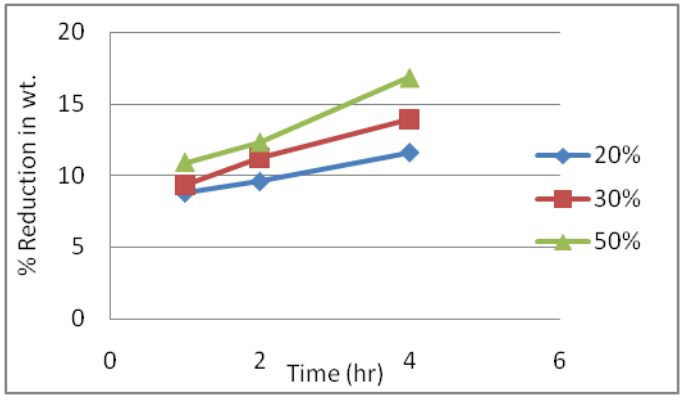

Figure 8: Effect of concentration of osmotic solution on weight reduction at 27°C

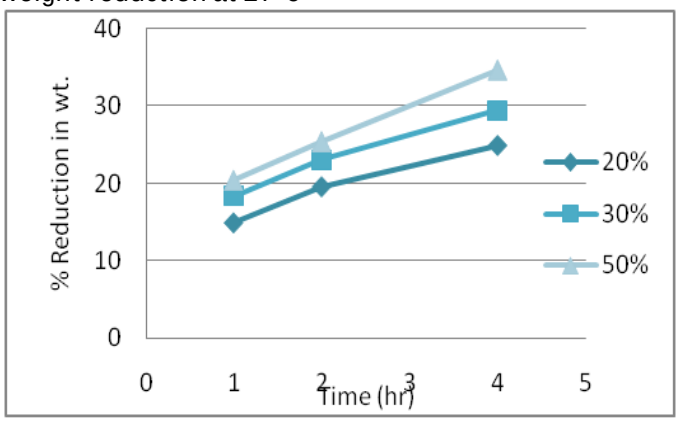

Figure 9: Effect of concentration of osmotic solution on weight reduction at 35°C

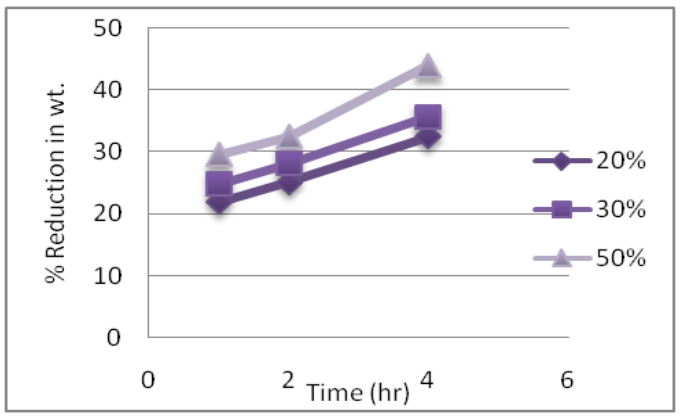

Figure 10: Effect of concentration of osmotic solution on weight reduction at 45°C

4. CONCLUSION

Osmotic dehydration is gaining importance in removal of water from fruits & other agricultural products due to its major advantage of retention of gloss, texture & colour of dried products. The objective of the present work was to study osmotic dehydration of orange carpel. Based on the observations, results and discussion, it can be said that, orange carpel can be partially dewatered by osmotic dehydration in sugar solution and % weight reduction is from 44 to 9 depending upon the operating parameters like sugar solution concentration, solution temperature and duration of osmosis.

It can be concluded that the favoured operating parameters are, sugar solution concentration around 50% & temperature around 45°C with time duration of osmosis around 240 minutes. The visual observation of the dried product is indicative of acceptable quality with little loss of texture & little bit of shrinkage.

ACKNOWLEDGMENT

Authors are thankful to director of L.I.T. Nagpur for facilities & constant motivation throughout work.

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BIOGRAPHIES

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