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Research Article

PREPARATION OF SAPOTA CANDY

***Hiremath,J.B and Rokhade,A.K.,**
Department of Post Harvest Technology, K.R.C.C.H.Arabhavi-591310
**Author for Correspondence*

ABSTRACT
The investigation on processing of sapota fruits was conducted during the year 2005-06 in the Department of Post-harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi, district Belgaum, Karnataka. Sapota candy was prepared with initial steeping in different concentration of syrup (40, 50 and 60°Brix) with or without citric acid with or without blanching. The mean maximum scores for colour and appearance, taste, flavour and overall acceptability was recorded in the candy prepared with initial syrup strength of 60°Brix with one per cent citric acid, whereas maximum score for texture was observed in candy with initial syrup strength of 40°Brix with one per cent citric acid with or without blanching.

INTRODUCTION
Sapota, *Manilkara achras* (Mill.) Fosberg (Syn: *Achras zapota* L.), is one of the most important tropical fruits belonging to the family sapotaceae. It is popularly known as chikku. It is one of the delicious fruits of humid tropical and subtropical regions. Sapota is mainly valued for its sweet and delicious fruits. It is primarily used as dessert fruit. Sapota fruit is a good source of digestible sugar, which ranges from 12 to 20 per cent and it is virtually a treasure of minerals such as iron and calcium. The fruits have an appreciable amount of protein, fat, fibre, calcium, phosphorus, iron, carotene and vitamin C (Shanmugavelu and Srinivasan, 1973). It is also rich in bio-iron required for the formation of haemoglobin (Gursharan Singh, 2001). India is the largest producer of sapota followed by Mexico, Guatemala and Venezuela. In the last ten years area under the crop has shown a tremendous increase of over 136 per cent (Maya *et al*., 2003). It has been observed that when there is a bumper production of sapota the fruit goes as waste for want of suitable preservation facilities. Thus, considering the fast increasing area under sapota cultivation, preservation and processing technology needs to be developed in order to prevent huge post-harvest losses and regulate prices during glut period and thereby protecting the interest of the growers. However, there are no popular commercial products of sapota in the market. Hence, there is a need to develop a low cost technology for processing sapota fruits into value added products. Candy is highly acceptable product but information on preparation of candy from sapota fruit is lacking. In preparation of candy syrup concentration, type of osmotic agent, temperatures of osmotic solution are very important. Therefore, the present investigation was undertaken with the objectives of standardization of procedure for preparation of candy, standardisation of syrup concentration and to develop sapota pulp based products.

MATERIALS AND METHODS
Kalipatti, a commercially important cultivar of this region was used for the study. The design adopted for this experiment was factorial completely randomised design (FCRD) with three replications, nine treatments as Factor-I and four stages of storage as Factor-II. (Initial, One month after storage, Two months after storage, Three months after storage)
Healthy, good quality just ripe fruits were selected for candy preparation. Unripe, over ripe, diseased and damaged fruits were discarded. The fruits were washed under clean tap water. The skin was removed by hand peeling using stainless steel peeler. The fruit was cut into eight slices, seeds and cores were removed. The slices of sapota were steeped in syrup of 40, 50 and 60°Brix with or without citric acid as per the treatment details. The quantity of syrup used in the ratio of 2 : 1 (syrup : fruit pieces w/w). In treatments seven, eight and nine, slices were blanched in water containing 0.2 per cent KMS for one minute before steeping in respective syrups. After 24 hours of steeping in each treatment, the syrups were drained and their concentrations were increased by adding sugar and heating. The quantity of sugar to be

Table 1. Changes in colour and appearance and texture of sapota candy as influenced by treatments and storage period (scores out of 5.0)

Treatments	Colour and appearance					Texture				
	Initial	1 MAS	2 MAS	3 MAS	Mean	Initial	1 MAS	2 MAS	3 MAS	Mean
T_1 – Steeping in 40°B syrup and increasing daily by 10°B upto 70°B	4.25	4.10	4.00	3.95	4.07	4.25	4.20	4.10	4.05	4.15
T_2 – Steeping in 50°B syrup and increasing daily by 10°B upto 70°B	4.00	3.90	3.85	3.80	3.89	4.00	3.95	3.90	3.85	3.92
T_3 – Steeping in 60°B syrup and increasing daily by 10°B upto 70°B	3.75	3.70	3.69	3.65	3.69	3.75	3.60	3.50	3.40	3.56
T_4 – Steeping in 40°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.25	4.20	4.15	4.10	4.17	4.50	4.40	4.35	4.30	4.39
T_5 – Steeping in 50°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.50	4.45	4.40	4.30	4.41	4.25	4.15	4.10	4.05	4.14
T_6 – Steeping in 60°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.75	4.70	4.69	4.65	4.69	4.00	3.95	3.90	3.80	3.91
T_7 – Blanching in 0.2% KMS solution + steeping in 40°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.00	3.95	3.90	3.89	3.93	4.50	4.40	4.35	4.30	4.39
T_8 – Blanching in 0.2% KMS solution + steeping in 50°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.50	4.40	4.30	4.20	4.35	4.00	3.95	3.85	3.80	3.90
T_9 – Blanching in 0.2% KMS solution + steeping in 60°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.75	4.70	4.60	4.50	4.64	3.75	3.60	3.50	3.40	3.56
Mean	4.31	4.23	4.17	4.11	4.21	4.11	4.02	3.95	3.88	3.99
For comparing the means of	S.Em±		C.D. at 1%			S.Em±		C.D. at 1%		
Treatments (T)	0.033		0.122			0.038		0.144		
Storage period (S)	0.022		0.081			0.026		0.095		
Interaction (T x S)	0.066		NS			0.077		NS		

MAS = Months after storage NS = Non-significant

Table 2. Changes in taste and flavour of sapota candy as influenced by treatments and storage period (scores out of 5.0)

Treatments	Taste					Flavour				
	Initial	1 MAS	2 MAS	3 MAS	Mean	Initial	1 MAS	2 MAS	3 MAS	Mean
T_1 – Steeping in 40°B syrup and increasing daily by 10°B upto 70°B	3.50	3.40	3.35	3.30	3.39	3.75	3.50	3.25	3.00	3.37
T_2 – Steeping in 50°B syrup and increasing daily by 10°B upto 70°B	4.75	4.70	4.60	4.55	4.65	4.00	3.90	3.75	3.65	3.82
T_3 – Steeping in 60°B syrup and increasing daily by 10°B upto 70°B	4.50	4.35	4.30	4.25	4.35	4.00	3.90	3.80	3.75	3.86
T_4 – Steeping in 40°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.50	4.40	4.35	4.30	4.39	4.50	4.25	4.10	4.00	4.21
T_5 – Steeping in 50°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.25	4.30	4.25	4.20	4.25	4.50	4.30	4.25	4.10	4.29
T_6 – Steeping in 60°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.75	4.70	4.60	4.50	4.64	4.75	4.65	4.50	4.25	4.54
T_7 – Blanching in 0.2% KMS solution + steeping in 40°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	3.75	3.70	3.60	3.50	3.64	3.75	3.65	3.50	3.35	3.56
T_8 – Blanching in 0.2% KMS solution + steeping in 50°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	3.50	3.40	3.35	3.30	3.38	3.50	3.40	3.25	3.00	3.29
T_9 – Blanching in 0.2% KMS solution + steeping in 60°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.00	3.90	3.85	3.80	3.88	4.00	3.85	3.75	3.50	3.77
Mean	4.17	4.09	4.03	3.97	4.06	4.08	3.93	3.79	3.62	3.86
For comparing the means of	S.Em±		C.D. at 1%			S.Em±		C.D. at 1%		
Treatments (T)	0.034		0.126			0.072		0.267		
Storage period (S)	0.023		0.085			0.048		0.178		
Interaction (T x S)	0.068		NS			0.144		NS		

MAS = Months after storage NS = Non-significant

Table 3. Changes in overall acceptability of sapota candy as influenced by treatments and storage period (scores out of 5.0)

Treatments	Overall acceptability				
	Initial	1 MAS	2 MAS	3 MAS	Mean
T_1 – Steeping in 40°B syrup and increasing daily by 10°B upto 70°B	3.75	3.60	3.50	3.40	3.56
T_2 – Steeping in 50°B syrup and increasing daily by 10°B upto 70°B	4.25	4.15	4.10	4.00	4.12
T_3 – Steeping in 60°B syrup and increasing daily by 10°B upto 70°B	4.00	3.95	3.90	3.75	3.90
T_4 – Steeping in 40°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.50	4.40	4.30	4.25	4.36
T_5 – Steeping in 50°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.25	4.20	4.15	4.00	4.15
T_6 – Steeping in 60°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	4.75	4.65	4.60	4.50	4.62
T_7 – Blanching in 0.2% KMS solution + steeping in 40°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	3.75	3.70	3.60	3.50	3.64
T_8 – Blanching in 0.2% KMS solution + steeping in 50°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	3.50	3.45	3.40	3.25	3.40
T_9 – Blanching in 0.2% KMS solution + steeping in 60°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B	3.75	3.70	3.60	3.50	3.64
Mean	4.06	3.98	3.91	3.79	3.93
For comparing the means of	S.Em±		C.D. at 1%		
Treatments (T)	0.042		0.155		
Storage period (S)	0.028		0.103		
Interaction (T x S)	0.083		NS		

MAS = Months after storage NS = Non-significant

added to obtain the required strength of syrup was calculated by Pearson's square method (Giridharilal *et al.*, 1986). The syrup concentration was increased by 10°Brix daily until the syrup concentration reached 70°Brix in all the treatments. The slices were kept in 70°Brix syrup for a period until the equilibrium was reached between the slices and the syrup concentration (70°Brix), *i.e.*, there was no decrease in syrup concentration. The slices in each treatment were drained free of syrup, rinsed immediately with tap water and shade dried for 24 hours. The candy were packed in 250 gauge polyethylene bags and stored under ambient condition.

RESULTS

The data pertaining to the colour and appearance and texture of sapota candy as influenced by treatments, storage period and their interaction effects are presented in Table 1. The mean score for colour and appearance of the treatments irrespective of storage period varied between 3.69 and 4.69. The treatment T_6 (4.69) recorded significantly highest score, whereas lowest score was observed in T_3 (3.69). The mean scores for colour and appearance at different storage periods irrespective of treatments showed a significant linear decrease from 4.31 at initial stage to 4.11 at three MAS.

The mean scores for texture of the treatments irrespective of storage periods varied between 3.56 and 4.39. The treatments T_4 and T_7 recorded maximum scores of 4.39, whereas least was recorded in T_3 and

T_9 (3.56). Scores for texture at different storage periods irrespective of treatments showed significant decrease from 4.11 at initial stage to 3.88 at three MAS. The interaction effect between treatments and stages of storage period was found to be non-significant with respect to both colour and appearance and texture of sapota candy.

The data pertaining to the organoleptic scores for taste and flavour of sapota candy as influenced by treatments and storage periods are presented in Table 2. The mean score for taste of the treatments irrespective of storage period differed significantly; it was maximum in T_2 (4.65), which was on par with T_6 (4.64). The least score was observed in T_8 (3.38), which was on par with T_1 (3.39). The mean score for taste at different storage periods irrespective treatments also varied significantly. It decreased linearly from 4.17 to 3.97 from initial to three MAS.

Maximum mean score for flavour of sapota candy was recorded in T_6 (4.54) followed by T_5 (4.29) and T_4 (4.21), whereas least score was noticed in T_8 (3.29). The mean score for flavour at different storage periods irrespective of treatments also varied significantly. It decreased linearly from 4.08 at initial stage to 3.62 at three MAS. The interaction effects between treatments and storage period of sapota candy with respect to taste and flavour were found to be non-significant.

The results of organoleptic evaluation for overall acceptability of sapota candy as influenced by treatments and storage periods are presented in Table3.

The mean score for overall acceptability irrespective of storage period was maximum in T_6 (4.62) followed by T_4 (4.36), whereas minimum score was observed in T_8 (3.40). The mean score for overall acceptability irrespective of treatments was highest at initial stage (4.06), which decreased marginally to 3.79 at three MAS. However, the interaction effect was found to be non-significant.

DISCUSSION

Not all the fruits are suitable for its candy preparation. The fruits having firm texture are suitable for candy preparation. Since sapota fruits have firm texture at just ripe stage, they are selected for candy preparation.

Osmotic dehydration, *i.e.*, the process of removal of water from fruit slices by using high concentration syrups, is the main principle involved candy preparation. But optimum concentrations of sugar syrup and the duration of treatment need to be worked out with each kind of fruit in order to get candy of good quality. But little work has been done on this aspect in case of sapota. Therefore, in the present investigation, an attempt was made to standardise the procedure/recipe for preparation of sapota candy. The data on organoleptic score were different for sensory characteristics revealing that the overall sensory evaluation scores were higher in treatments involving citric acid compared to the treatments without citric acid. This may be attributed to the balanced sugar acid ratio due to the addition of citric acid to the syrup. Similar findings were also reported by Unde (1998) in sapota, Unde *et al*. (1998) and Kannan and Susheela (2002) in ber candy, Sharma *et al*. (1998) in apple candy.

Even though there was marginal decrease in the organoleptic scores for different sensory traits, the mean scores of the treatments were found to be between 3.60 and 4.11 at the end of three months of storage. The mean scores of 3.6 and above indicated that the candy was wholesome and highly acceptable at the end of three months. Similar findings of decrease in organoleptic scores of candy during storage were observed by Anjali *et al*. (2005) in lemon peel candy and Sharma *et al*. (1998) in apple candy.

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