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EFFECT OF DIFFERENT LEVELS OF SUGAR IN THE PREPARATION OF PINEAPPLE (*Ananas comosus L.*) CANDY

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Abstract- Post-Harvest Laboratory were carried out to know the different sugar levels for preparation the pineapple candy and to investigate the physic-chemical changes during storage in order to assess acceptability as well as shelf life of the product. Out of three levels tested, the 75% total soluble solids treatment was found optimum for getting desired results. Ascorbic acid was totally lost during treatments and product preparation. There was a little progress in acidity and reducing sugar upto 60 days of storage period. After 60 days quality product decrease. Fruit processing with 75% total soluble solids observed best in phsico-chemicals during storage period.

Keywords- Post harvest, processing, pineapple, candy

Introduction

Pineapple (*Ananas comosus* L.) belonging to the family Bromeliaceae is one of the principal commercial fruit of the world. With tribal migration and trodes between tribes, the pineapple cultivars were distributed throughout most of tropical America and the species developed into a cuttigen in the process. The world production of pineapple has shown a steady increase due to the expansion of pineapple industry in the developing countries. It is grown mostly in West Bengal, Assam, Karnartaka, Maghalaya, Manipur, Nagaland. Due to inappropriate harvesting and post harvest management practices about 20-40% fruits worth ₹ 4000 crores are lost annually. Losses generally occur during handling, packaging, transportation, marketing and storage. In India pineapple fruit are processed into a number of value added products like canned halves, Jam, juice, candy. Processing is the best way of utilizing surplus production of fruits particularly during the period of seasonal glut. The losses of fruits is minimized off season availability of pineapple . The present study was under taken to standardize an appropriate technique of candy making and study the storage stability of pineapple candy vis -à-vis the nutrient losses, as a function of shelf life, packaging material and storage conditions. There are many factories, which are engaged in the manufacturing of different kinds of candy for distribution and sale in the country as well as abroad being an India product, it has got an exotic appeal also and thus has created god export market. When we make candy, our goal is always the same to have flavor so good that it literally blows the competition out of the water. The approximate sugar content of popular foods in teaspoons full of granulated sugar was compiled from current publications of food values candy runs from 75% to 85% sugar. Popular candy bars are likely to weight one to five ounces and may contain five to twenty teaspoons sugar. Hence a study was conducted to find out the effect of different level of sugar in the preparation of pineapple candy and shelf life of product.

Material and Methods

The experiment was conducted in the PRESERVATION LABORATORY, Department of Horticulture, Allahabad Agricultural Institute-Deemed University, Allahabad during 2005-06. Ripe pineapple fruits were taken for preparation of its candy. The experiment was consisted of five treatments of sugars concentration T_1-65% total soluble solids (T.S.S.), T_2-70% T.S.S., T_3-75% T.S.S., T_4-80% T.S.S. and T_5-85% T.S.S. with three replications in completely randomized design (C.R.D.) [Fig-1].

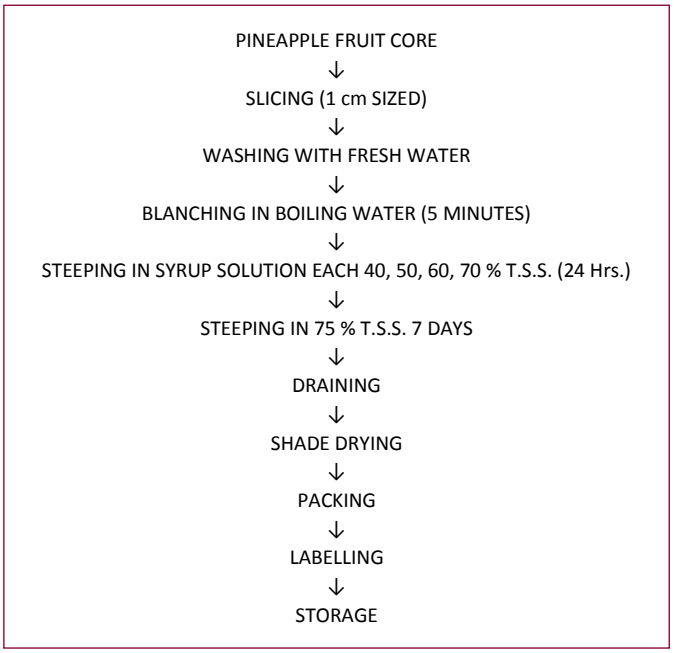

Fig. 1- Flow chart for the preparation of candy from pineapple fruit

Fruits were peeled and core was separated from flesh. Core was cut into slices of 1 cm thickness. The slices were washed with water and blanched in boiling water for 5 minutes. The slices were steeped in sugar syrup of 40 percent total soluble solids for about 24 hrs. The pieces were drained out and the strength of syrup was raised by 10 percent total soluble solids, the pieces were again steeped in sugar syrup for 24 hrs. This process was repeated every 24 hrs. until it reached the desired concentration of recipes. The

slices were steeped in this concentration for a week, when drained and shads dried. The prepared products were evaluated organoleptically to find out the ideal recipe for candy of pineapple fruits. About 250g candy was packed in polythene bag. The packaged products were kept at the ambient temperature for the storage studies. Observations on total soluble solids, acidity, ascorbic acid and organoleptic quality were recorded at 20 days intervals. TSS was estimated by hand refractometer and for acidity sample was diluted with distilled water and titrated against 0.1 N NaOH using phenolphthalein as an indicator [7]. Ascorbic acid content was estimated by titrating aliquot against 2,6-dichlorophenol indophenol dye solution as described by Ranganna, [7]. The organoleptic evaluation for asserssing sensory attributes of the samples was calculated by a panel of seven judges. The sample were rated on hedonic rating scale where and a respresented disliked extremely and liked extremely, respectively.

Results and Discussion

Mean values of total soluble solids of candies prepared through various pre-treatment and stored for 80 days are presented in [Table-1]. The candies prepared by pre-treatment T_4 and T_3 could retain maximum amount of TSS (82.67 ^{0}Brix and 77.33 ^{0}Brix) minimum leaching to TSS, was found in T_1 (66.67 ^{0}Brix) after 80 days storage candy. On storage maximum TSS (82.67 ^{0}Brix) was found in 80 days followed by 60 days (82.00 ^{0}Brix). The storage induce a significant increase in TSS content of all the candies irrespective of their pretreatment. The total soluble solids (TSS) content was found to be 8.48 ^{0}Brix in fresh fruit. However, the average TSS content of the processed candies during storage were varied (80.00 ^{0}Brix to 82.67 ^{0}Brix) with the above data it is clear that the processing employed for preparation of candy has forced out the water content to give place to the soluble solids in terms of sugar and other soluble ingredients present in the various pre-treatments. The reports by Bhat, et al. [2] with the aonla candy also showed increased TSS content of the fruit.

Table 1- Changes in the total soluble solids (TSS) ^{0}Brix and Acidity (%) of candy as affected by various treatments

Treatments	TSS °Brix					Acidity (%)				
	0 days	20 days	40 days	60 days	80 days	0 day	20 days	40 days	60 days	80 days
T_1	65	65.33	65.67	66	66.67	0.61	0.64	0.64	0.65	0.56
T_2	70	70.3	71	71.67	72.33	0.6	0.62	0.64	0.66	0.57
T_3	75	76	76	76.67	77.33	0.61	0.62	0.63	0.64	0.58
T_4	80	81.34	81.35	82	82.67	0.6	0.61	0.62	0.63	0.59
T_5	85	85.33	85.67	86.33	87	0.59	0.59	0.59	0.61	0.59
SE.m±	0.82	0.98	0.52	0.63	0.76	0.02	0.01	0.01	0.01	0.01
CD at 5%	2.54	3.03	1.61	1.96	2.36	NS	0.03	0.02	0.03	0.02

In all the 5 treatment of the present investigation, TSS content of pineapple candies followed a consistently increasing trend as the storage period increased [Table-1] and [Fig-1]. Barmanray, et al. [1] reported in guava nectar, an increase in TSS content with the increase in storage period during 80 days of storage. Increase in TSS might be due to conversion of remaining Polysacchrides into monosaccharides. Dhawan and Gupta [4] reported that due to the conversion of some of the insoluble fractions into soluble fraction. Similar trend was reported by Singh and Kumar [9] in raw aonla fruit.

Mean values of titrable acidity of different candies stored for 2 months 20 days are given in [Table-1]. For more fruitful discussions of the results for comparing the titrable acidity of different candies. It was found that there was general loss in acidity because of processing of fruit through various pre-treatments and preparation of candies. This table also indicated that the titrable acidity of different candies on 0 day varied from 0.59 to 0.61% statistical analysis also indicated a significant variation in the titrable acidity of the candies from various treatments. The maximum titrable acidity of the fresh candy was recorded in T_3 as 0.61% and minimum (0.59%) in T_5. The maximum acidity of 0.61% further increased recorded to 0.64% after 60 days of storage, but decreased to 0.58% 80 after days storage period.

The acidity of fresh pineapple fruit was found to be 0.69% where as the acidity of the different candies prepared by different pre-treatments varied from 0.56% to 0.59%. This clearly showed a reduction in acidity because of the various types of treatments employed during processing for candy. Data presented in the [Table-1] revealed that the highest acidity was present in the T_3 (0.61) and lowest in T_5 (0.59). It was evident from the same table that the all treatment showed the decreasing trend in acidity during storage period. Increase in acidity during storage of other fruit candy have also been observed by many workers [3,10]. This type of trend in the acid content of the candies prepared by all 5 treatments of the candies could be mainly due to formation of sulphurous acid during storage.

[Table-2] comprised the mean value of ascorbic acid content of various candies prepared through different pre-treatments and stored for 2 months and 20 days. In general the processing of the fruits through various pre-treatments employed for preparation of candies resulted in remarkable loss of vitamin 'C' for a value of 15.19 mg/100 g fresh fruits. The ascorbic acid content of candies varied from 6.64 mg/100 g to 5.63 mg/100 g during storage.

Table 2- Changes in ascorbic acid content (mg/100g) and reducing sugar (%) of candy as affected by various treatments

Treatments	Ascorbic Acid (mg/100g)					Reducing Sugar (%)				
	0 day	20 days	40 days	60 days	80 days	0 day	20 days	40 days	60 days	80 days
T_1	6.61	6.06	6.04	6.02	5.87	47.62	47.66	48.42	48.47	49.33
T_2	6.61	6.43	6.28	6.02	5.9	48.03	48.03	49.23	50.4	53.67
T_3	6.64	6.45	6.23	6.01	5.94	52.73	52.8	53.77	54.67	54.5
T_4	6.63	6.2	6.14	5.94	5.75	53.47	55.63	57.8	58.73	61.93
T_5	6.62	6.6	6.01	5.88	5.63	55.01	61.33	62.9	63.87	67.4
SE.m±	0.03	0.17	0.01	0.21	0.69	3.15	1.4	1.1	0.72	2.12
CD at 5%	0.09	0.51	0.39	0.67	0.21	NS	64.37	3.4	2.25	6.6

There was a significant variation in ascorbic acid content of the candies prepared through various treatments. The candy obtained from treatment T_3 was found to retain maximum ascorbic acid content 6.64 mg/100 g. Further perusal of the same table indicated a general, gradual and significant reduction in ascorbic acid content during the whole span of storage. The final products obtained after 80 days of storage contained ascorbic acid ranging from 5.94 mg.100 g to 5.63 mg/100g. The ascorbic acid content in the original fruits was found to be 15.19 mg/100g. While the ascorbic acid content of the candies prepared through various pre-treatments were found to vary from 5.63 to 5.75 mg/100 g candies showed heavy losses of vitamin C during processing. In the fresh candy maximum amount of ascorbic acid 6.64 mg/100 g was estimated in treatment T_3 were segmented steeping with 75% TSS. This reduction in ascorbic acid content might be due to oxidation.

[Table-2] comprised the mean value of reducing sugar content of various candies prepared through different treatment and stored for 2 months & 20 days. The reducing sugar continued varied from

55.01 to 47.62 in the fresh candies. There were a significant variation in reducing sugar content of the candies prepared through various pre-treatments. The candy obtained from treatment T_5 was found the retain significantly maximum reducing sugar (55.01%), followed by T_4 (53.47%) whereas candy processed through pre-treatment T_5 was found to retain minimum amount of reducing sugar i.e. 47.62% (T_1).

It is evident from the [Table-2] that there is gradual and significant increase in reducing sugar content throughout storage period. At 2 months and 20 days after storage the reducing sugar ranges from 67.40% to 49.33%. The maximum (67.40%) was recorded in T_5 followed by T_4 both being at par. While minimum sugar content was found in T_1 (49.33%). The increase in reducing sugar might be due to breakdown of Polysaccharides into *Eligas saccharides* and monosaccharide. Mean score of colour of the candies prepared by various methods is given in [Table-3]. The mean of data exhibited that the various method have significantly influenced the colour and appearance of the candies. The candy prepared with pre-treatment of 75%, total soluble solids (T_3) rated best (6.33) in colour and appearance which was significantly superior to other candies in T_4 (6.33), T_2 (5.33), T_5 (5.01) and T_1 (5.00).

It was evident from the [Table-3]. The colour in pineapple candy improved upto 60 days thereafter declined with the advancement of the storage period. Similar findings were reported by Hughes and Banion, [6] in gooreberry preserve, Gupta, [5] in Ber candy. Mean scores for texture of the candies are given in [Table-3]. The data showed that candies prepared by treatment T_3 rates best texture with the maximum score of 7.67 followed by the candies prepared by treatment T_4 (7.00). Texture in T_3 and T_4 might be due to the better lime treatment (Hardens the tissues) in Preparation of Pineapple candy.

Table 3- Changes in sensory score for colour and Texture of candy as affected by various treatments.

Treatments	Colour					Texture				
	0 day	20 days	40 days	60 days	80 days	0 day	20 days	40 days	60 days	80 days
T_1	5	5.67	6	6.33	4.33	6	6.33	7	7.33	5.33
T_2	5.33	6.33	6.67	7	5.33	6.67	7	7.33	8	6
T_3	6.33	7.67	8.33	8.33	6.33	7.67	8	8.33	8.67	7.33
T_4	6.33	7	7.67	7.67	6	7	7.67	7.67	7.67	6.33
T_5	5	6.67	6.67	7.33	4.67	6.33	6.33	7.33	7.33	5.67
SE.m±	0.51	0.42	0.42	0.42	0.66	0.51	0.36	0.42	0.42	0.42
CD at 5%	1.6	1.31	1.31	1.31	2.07	1.6	1.13	1.31	1.33	1.31

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