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Standarditation of Sapota Juice Concentrate and Its Quality Characteristics

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ABSTRACT

In the present study, an attempt was made to study on Optimizing processing and preservation techniques of sapota juice from the selected three varieties PKM 1, PKM 4 and Kirtibarthi were chosen for further study and to develop value added products from the selected varieties. Based on the juice yield, sensory quality and fruit seasonal availability the three varieties were chosen. The value added products from these varieties were developed based on clarification and concentration. The sapota pulp of the above sapota varieties were processed into clarified juice and juice concentrate. Sapota juice concentrate pH values were less change are seen in LDPE (P_1) compared to other two packaging materials. The acidity of the concentrate showed slow increase through stored at low temperature. No change in TSS was seen in during storage of 3 months, which could be due to storage at low temp. The per cent total sugar and reducing sugar, PKM 1 had comparatively higher values of total sugar and reducing sugar. A small loss in ascorbic acid was observed in the varieties during storage. On storage there was appreciable increase in bacteria, fungi and yeast despite low temperature storage. Taste and flavor was best in PKM 1 LDPE packaging was found to perform better than other two packaging in retaining the goodness of the juice.

Key words: *Variety, Packaging, Processing, Temperature, Juice.*

INTRODUCTION

In India, sapota ranks fifth both in production and consumption next to mango, banana, citrus and grapes. Sapota (*Manilkara achrasL.*) is one of the important tropical fruits belonging to the family *Sapotaceae*. It is called by many names viz., chikku, sapodilla plum, zapota and nose-berry. At present, it is cultivated in all the tropical countries of the world.

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Sapota is a climacteric fruit and is highly appreciated for its pleasant flavour, sweet taste and deep orange red colour of the pulp. The annual post harvest losses of fruits and vegetables is about 25 to 30 per cent due to spoilage, inadequate post harvest handling, lack of processing facilities, transport, storage and marketing.

Fruits and vegetables contribute a crucial source of nutrients in daily human diet. The world fruit production is estimated to be 434.7 million MT and vegetables 90.0 million MT. India is the second largest fruits and vegetable producer and its annual production is 80,000 to 85,000 MT from an area of 6982 ha and its productivity is 11.64 MT per hectare during 2012-2013. At present, India accounts for 10.1 per cent of the total world population of fruit crops and ranks second with production of 77700.56 MT in 2011 - 2012 next to China[3].

Tamil Nadu ranks fourth in the sapota producing states in the country and accounts for 17 per cent of the total production of sapota in the country. The state produces about 0.24 MT of sapota from an area of 0.009 m. ha. with productivity of 27 t/ha. The variety of sapota grown in the state are Guthi, Kirtibarthi, Pala, CO 1, CO 2 and PKM 1[3]. Hence, the present study was sapota varieties were processed into juice concentrate and studied the quality parameters.

MATERIALS AND METHODS

Selection of fruits

The seven varieties of sapota fruits were collected from Horticultural College and Research Institute, Periyakulam, Tamil Nadu Agricultural University, Tamil Nadu, India. They are PKM 1, PKM 4, PKM 5, CO 1, CO 2, Kallipatti and Kirtibarthi. The fruits were inspected thoroughly to avoid any damaged and spoiled fruits. They were ripened at ambient temperature (22^0C).

Pulping of sapota fruits

Ripened fruits were washed in tap water, peeled and sliced into small pieces. The sliced fruits were ground into pulp using mixie. The sapota pulp was treated with 70ppm of potassium metabisulphate, as pretreatments are necessary to prevent discoloration and microbial growth during processing. The ground pulp was kept under refrigeration (4 ± 1^oC) condition before use.

Chemical characteristics

Chemical characteristics of fresh fruit: The chemical characteristics such as total soluble solids, acidity, pH, total sugar, and reducing sugar were analysed in fresh sapota fruits.

pH: The pH of the samples was estimated by the method described by Saini*et al*[5]. Five gram of the sample was mixed well by stirring with 50 ml of distilled water using a glass rod and the pH of the suspension was determined in the pH meter. This procedure was followed for all the products.

Acidity: Acidity of the samples was estimated by the method described by Saini*et al*[5]. About 5 g of the sample was weighed and dissolved in a known quantity of water and made upto 50 ml and filtered. From the filtrate, an aliquot of sample was taken and titrated against 0.01 N NaOH using phenolphthalein as an indicator till the appearance of permanent pale pink colour. The titration was repeated to obtain concordant values. Acidity was expressed as percentage.

$$= \frac{\text{Titre value x equivalent of acid x normality x volume made up x 100}}{\text{Volume of sample taken x weight of sample x 1000}}$$

Total soluble solids: The total soluble solids of the samples were observed by using a hand refractometer (0 to 90º brix). The drop of sample was kept on the hand refractometer and the brix was noted by Saini *et al*[5].

Reducing sugar and total sugar: The sugar content of the samples was determined by Shaffer Somogyi micro method described by McDonald and Foley[2]. For the estimation of reducing sugar, five-gram sample was accurately weighed, boiled with distilled

water, cooled and made up to 250 ml and then filtered. The filtrate was clarified using lead acetate solution and deleaded with potassium oxalate solution. The reducing sugar content of the sample was determined by iodometric titration of the reduced cuprous oxide. For estimating the total sugar, the clarified deleaded aliquots were hydrolyzed using 1 N hydrocholoric acid at room temperature for 24 hours. After neutralization, the total sugar present in the sample was estimated by iodometric titration of the reduced cuprous oxide and expressed as percentage.

Calculation

$$\text{Reducing and total sugar (\%)} = \frac{\text{mg of dextrose x volume made up x 100}}{\text{Weight of the sample taken x 5 x 1000}}$$

$$\text{mg of dextrose} = \frac{\text{Blank titre value} - \text{Sample titre value}}{\text{Blank titre value} - \text{standard titre value}}$$

Ascorbic acid

The ascorbic acid content was estimated by following the procedure of Sadasivam and Manickam[4]. Hundred mg of ascorbic acid was accurately weighed and made up to 100 ml with 4 per cent oxalic acid (stock standard). Working standard was prepared with 10 ml of the stock standard and diluted to 100 ml in a volumetric flask giving a concentration of 0.1 mg of ascorbic acid per ml. 52 mg of dichlorophenol indophenol dye and 42 mg of sodium bicarbonate was weighed accurately and diluted to 200 ml with distilled water. A sample of 5 g was extracted with 4 per cent oxalic acid and was made up to 100 ml. An aliquot was titrated against 2, 6 dichlorophenol indophenol dye. The amount of ascorbic acid present in the sample was calculated and expressed as mg of ascorbic acid per 100 g of sample on fresh weight basis (FWB).

Processing of Sapota Juice Concentrate

Pulping of sapota fruits: Ripened fruits were washed in tap water, peeled and sliced into small pieces. The sliced fruits were ground into pulp using mixie. The sapota pulp was treated with 70ppm of potassium metabisulphate.

Juice extraction: The sapota fruit pulp from the three varieties were mixed with water 1:1 (W/V) and made into a homogeneous fruit pulp. The juice was extracted from the homogenized pulp by filtering through double fold muslin cloth. The extracted fresh juice was kept under refrigeration (4±1^{o}C) condition before use.

Sapota Juice Concentration

FPO specification for Concentrate

Minimum TSS 15 %

Maximum acidity 3.5%

A 200 ml of sapota juice with an initial total soluble solid of 10°Brix was put in a round bottom flask and concentrated by laboratory rotary vacuum evaporator (EL-131 model Büchi, Switzerland) under 200 mbar vacuum pressures until obtaining the desired final concentration of 45°Brix. During the evaporation process, the sample was heated by immersing it in a 55°Cwater bath warmed by a 1500 watt electrical power heater. The product recovery is presented in Table 1.

Table 1: Parameters for the production of concentrate from sapota fruit juice

Variety	Initial (^{o}Brix)	Vacuum Level (kPa)	Water bath temperature (^{o}C)	Juice (ml)	Final (^{o}Brix)
PKM 1	10	07.2	55	1000	45

Packing: Sapota juice concentrate was packed in (P_1) Low density polyethylene pouches (LDPE), (P_2) High density polyethelene pouches (HDPE) and (P_3) PET bottles.

Storage: The packed concentrates were stored at 4°C. The concentrate samples were analyzed periodically during storage for 90 days.

Microbial Analysis

The microbial load of the stored products was enumerated by the method described by Istavankiss[1].

Preparation of medium: Nutrient agar medium was used for enumeration of bacteria, yeast extract malt agar medium was used for enumeration of yeast, martin's rose bengal agar medium was used for enumeration of fungi. The chemicals were accurately weighed and dissolved in distilled water by medium heating and sterilized for 20 minutes at 15psi. The chemicals required for the preparation of media as follows:

RESULT AND DISCUSSION

Processing of Sapota Juice Concentrate

Changes in Quality attributes in sapota juice concentrate during storage

Sapota juice concentrate was packed in (P_1) Low density polyethylene (LDPE), (P_2) High density polyethylene pouches (HDPE) and (P_3) PET bottles and sealed pouches were stored at low temperature. Sapota juice concentrate characteristics such as pH, TSS, acidity, reconstituted juice and color value were analysed during storage for 90 days at low temperature.

Table 2: Changes in pH and acidity of PKM1 sapota juice concentrate during storage

Storage periods (days)	pH			ACIDITY (%)		
	P_1	P_2	P_3	P_1	P_2	P_3
0	5.42	5.42	5.42	0.089	0.089	0.089
30	5.40	5.39	5.39	0.090	0.091	0.091
60	5.38	5.36	5.35	0.092	0.093	0.941
90	5.35	5.32	5.32	0.093	0.094	0.945

Table 3: Changes in TSS (^{0}brix) and Ascorbic acid (mg/100 g) of PKM1 sapota juice concentrate during storage

Storage periods (days)	TSS (^{0}brix)			Ascorbic acid (mg/100 g)		
	P_1	P_2	P_3	P_1	P_2	P_3
0	45.00	45.00	45.00	21.17	21.17	21.17
30	45.00	45.00	45.00	21.02	20.97	20.96
60	45.30	45.10	45.10	20.84	20.76	20.76
90	45.40	45.20	45.20	20.51	20.11	20.12

Table 4: Changes in total sugar (%) and reducing sugar (%) of PKM1 sapota juice concentrate during storage

Storage periods (days)	Total sugar (%)			Reducing sugar (%)		
	P_1	P_2	P_3	P_1	P_2	P_3
0	21.57	21.57	21.57	13.25	13.25	13.25
30	21.42	21.42	21. 42	13.17	13.17	13.17
60	21.29	21.14	21.07	13.33	13.25	13.25
90	21.14	21.01	20.93	13.41	13.33	13.29

P_1 - Low Density Polyethylene
P_2 - High Density Polyethylene
P_3 - PET bottle

The results revealed that the changes in pH of sapota concentrate, during storage of 90 days. Each of the varieties show statistical difference over storage time and packaging. Less change are seen in LDPE (P_1) compared to other two packaging materials. PKM 1 (T_1) showed minimum changes. The acidity of the concentrate showed slow increase though stored at low temperature. No changes in TSS were seen in during storage of 3 months, which could be due to storage at low temperature, the per cent total sugar and reducing sugar, PKM 1 had comparatively higher values of total sugar and reducing sugar. Over time there was decrease in total sugar and increase in reducing sugar. Ascorbic acid was marginally higher in PKM 1 small losses in ascorbic acid was observed in all the varieties during storage.

Vishal *et al*[6]., stated that the papaya juice concentrate was packed and stored in low temperature for the period of 30 days. Its initial pH value was 4.52 and finally it was decrease in to the pH value of 4.50, its initial acidity was 1.76 per cent and finally its increase in to the acidity value of 1.78 per cent, its initial TSS content was 68.08 and finally it was increase in to the TSS content of 68.22 in low temperature, the initial total sugar content was 67.15 per cent and finally it was decrease in to 67.18 per cent and its initial reducing content was 50.71 per cent and finally it was increased in to the reducing content of papaya juice concentrate was 51.05 per cent and its initial ascorbic acid content was 12.93 per cent and finally it decreased to 10.62 per cent at low temperature.

Changes in Microbial count (cfu ml^{-1}) of sapota juice concentrate during storage

Table 4: Microbial load on sapota juice concentrate during storage

		Microbial count (cfu ml^{-1})					
		Bacteria × 10^2		Fungi × 10^2		Yeast × 10^3	
		Initial	Final	Initial	Final	Initial	Final
PKM 1	P_1	1	4	0	2	0	2
	P_2	1	5	0	3	0	3
	P_3	1	5	0	3	0	2

P_1 - Low Density Polyethylene
P_2 - High Density Polyethylene
P_3 - PET bottle

Table 4 indicated that the sapota juice concentrate had no fungi and yeast initially but bacteria was found in all the varieties of sapota juice. On storage there was appreciable increase in bacteria, fungi and yeast despite low temperature storage. As per regulations of FSSAI for microbiological requirements of fruit concentrate the limits given are not more than 50 /ml for total plate count.

Vishal *et al*[6]., studied that the papaya juice concentrate was stored in low temperature for the period of 30 days. Its yeast and moulds counts were also very low after 15 days' storage and at the end of the 30 days storage the count was very low (<10 cfu/g). *E coli* was not detected in any of the storage conditions, indicating that product was free of pathogenic bacteria.

CONCLUSION

Less changes are seen in LDPE (P_1) compared to other two packaging materials. PKM 1 (T_1) showed minimum changes. The acidity of the concentrate showed slow increase through stored at low temperature. No change in TSS was seen during storage of 3 months, which could be due to storage at low temperature. PKM 1 had comparatively higher values of total sugar and reducing sugar. Over time there was a decrease in total sugar and increase in reducing sugar. Small loss in ascorbic acid was observed in PKM 1 varieties during storage.

The PKM 1 sapota clarified RTS juice showed a maximum acceptability score compared to PKM 1 varieties. Sapota juice concentrate stored in LDPE retained maximum nutrients during storage in low temperature compared to HDPE and PET bottle packaging. More number of value added products can be developed from sapota to improve the economic value of the produce thereby fetching better profit for the farmer.

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