

Effect of different citric acid levels and packaging materials on quality of sugar based papaya leather

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Abstract

Experiments were conducted to investigate the effect of citric acid levels and packaging materials on physico-chemical and sensory quality of fresh and as well as stored papaya leather. The citric acid levels of 0.5%, 0.75% and 1.0% were used for the preparation of papaya leather. After preparation of papaya leather, the finished products were packed in two packaging materials viz. PET jars and glass jars and stored at room temperature for quality evaluation at 15, 30, 45, 60, 75 and 90 days and sensory quality evaluation at 30, 60 and 90 days interval. The study revealed that the moisture content increased with citric acid levels. The TSS and vitamin C decreased with increase in the levels of citric acid. During storage there was a reduction in moisture content, pH and vitamin-C, where as TSS (total soluble solids) and optical density increases on storage. It is found that there is more loss of moisture and vitamin-C in PET jars as compared to glass jars. The organoleptic score of the leather samples in glass jars at 0.75% citric acid level was found to be higher followed by samples packed in PET jars.

Key words: TSS, acidity, pH, leather, papaya, processing, packaging material

Papaya (*Carica papaya* L.) is a tropical fruit. It is originated in Central America, Mexico and Northern South America. Papaya is spherical or pear shaped fruits that can be as long as 20 inches. During the year 2009-10, India's papaya production was 3913 metric tonnes (Indian Horticulture Database 2010). The important papaya growing states are Andhra Pradesh, Tamil Nadu, Assam, Bihar, Maharashtra and Uttar Pradesh. The papaya fruits are rich source of vitamins, particularly ascorbic acid and β -carotene. Ready-to eat fruit bars are well established products and are being commercially prepared in our country. Fruit leathers from mango, papaya, pineapple, guava, juman and banana individually or in combination with different fruits (Mathur *et al.*, 1972, and Doreyappa Gowda *et al.*, 1995). Present investigation highlights the storage behaviour of sugar based papaya leather with different levels (0.5%, 0.75% and 1.0%) of citric acid packed in different packaging materials and kept at room temperature over a period of three months.

Materials and Methods

Preparation of Papaya leather: Papaya leather was prepared from evenly ripened fruit procured in bulk from local market. Papaya were washed to

potable water and remove dust, dirty particles and some bacteria's. Peeling was done manually. Pulping of papaya was done in Electric Juicer mixer. The papaya fruit pulp (1.0 kg) was mixed with 450 g of sugar, 7.25 g of citric acid for the preparation of papaya fruit leather with citric acid level of 0.5% after preparing papaya leather with citric acid level of 0.5% the same process is again done for the preparation of papaya leather with citric acid level of 0.75 and 1.0%. The mixture was heated with continuous stirring for 5 minutes after cooking 2 ml mixed fruit flavour is added in the blend. This blend was spread in the form of thin layer on a tray smeared with mustard oil and dried in the hot air oven at 45°C. The dried layer was cut into rectangular leather pieces (3.5x3.5x0.5cm) and packed individually in PET jars and glass jars and stored at room temperature for further study.

Physico-Chemical analysis: The physico-chemical analysis like moisture content (Hot air oven method), total soluble solids, pH, optical density, and Vitamin-C for the fruit papaya leathers were determined using standard methods recommended by Ranganna (2001) as fresh and after 15, 30, 45, 60, 75 and 90 days of storage period.

Organoleptic Evaluation: The papaya leather samples were evaluated as fresh and after 30, 60 and 90 days of interval by ten judges using 9-point Hedonic rating scale (Ranganna, 2001).

Results and Discussion

The data on changes in physico-chemical constituents of papaya leather as influenced by different citric acid levels and packaging materials is presented in Table 1 to 5.

Moisture content: Moisture content of samples increased with increased in citric acid levels and moisture content of samples decreased with storage period, the reason for such trend may attributed to inversion of sucrose into monosaccharide by citric acid which is more in hygroscopic nature than the sucrose (Bhandari *et al.*, 1997), (Bhandari and Howes, 1999) leading to relatively higher affinity for water molecules. Samples with higher level of citric acid undergone inversion of more sucrose and therefore, had higher final moisture content. From the table it is also shows that the moisture less decreases in glass jars as compared to the PET jars (Table 1).

TSS: TSS of leather samples decreased with increased in the levels of citric acid but the TSS of all leather samples prepared with different levels of citric acid increased with storage period. It is also showed that the TSS of samples packed in glass jars is higher as compared to the PET jars after storage of 90 days (Table 2).

pH: pH of the leather samples decreased with increased in the levels of citric acid. From the table it is also showed that the pH of the samples prepared with different levels of citric acid decreased during storage similar pattern of decreasing trend was reported by (Sivakumar *et al.* 2005) reason behind that the decreases pH is due to increases acidity. Among the packaging materials, the leather samples stored in PET jars had recorded higher pH followed by glass jars (Table 3).

Optical density: Optical density of the leather samples decreased with increased in the levels of citric acid. From the Table 4, it is also showed that the optical density of the samples prepared with different levels of citric acid increased during storage. This increases in non- enzymatic browning might be due to decrease in sulphur dioxide (Swaminathan, 1987; Mir and Nath, 1993), higher

temperature (Meyer, 1966), as expected from Arrhenius equation (Mir and Nath, 1993) and concomitant with heat and loss of sulphur dioxide content of the product (Rao and Roy, 1980 b). This might be due to reaction of sulphur dioxide with food constituents (sugars, pectin's, proteins and lipids), oxidation or due to volatilisation (Bolin and Boyle 1972; Echhoff and Okos 1986).

Vitamin-C: Vitamin-C of the leather samples decreased with increased in the levels of citric acid. From the table it is also showed that the Vitamin-C content of the samples prepared with different levels of citric acid decreased after 90 days of storage. The reason behind this is the ascorbic acid content decreased during storage due to oxidation of ascorbic acid to dehydroascorbic acid. This is due to oxidation or exposure of atmosphere oxygen while preparing the fruit leather (Fennema, 1977). The loss of Vitamin-C is more in samples packed in PET jars as compared to glass jars.

Sensory Evaluation: Table 6 shows the organoleptic score values for leather samples during storage. Results of sensory evaluation showed that the sensory attributes like colour, flavour, texture and taste of samples prepared with different levels of citric acid in glass jars were most acceptable up to 90 days of storage at room temperature. The results also indicated that samples prepared with citric acid level of 0.75% ranked high followed by 0.5% and 1.0% citric acid levels.

Conclusion

Physico-chemical, organoleptic changes were studied in papaya leather during storage at room temperature. Significant changes were noticed in moisture content, TSS, pH, optical density and Vitamin-C. The result indicated that the samples prepared with citric acid level of 0.75% ranked high followed by 0.5% and 1.0% citric acid levels. Among the packaging materials the samples packed in glass jars showed minimum nutrient loss and also retained maximum consumer acceptability scores.

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Table 1: Changes in Moisture content (%) of papaya leather during storage as affected by levels of citric acid and packaging materials

Storage Period (days)	PSC _{0.5}		PSC _{0.75}		PSC _{1.0}	
	PET JAR	GLASS JAR	PET JAR	GLASS JAR	PET JAR	GLASS JAR
Fresh	19.00 ± .008	19.00 ± .012	19.00 ± .014	19.00 ± .021	19.00 ± .021	19.00 ± .012
15	18.19 ± .045	18.80 ± .024	18.23 ± .020	18.83 ± .028	18.30 ± .047	18.95 ± .020
30	18.08 ± .008	18.62 ± .008	18.12 ± .020	18.64 ± .036	18.19 ± .036	18.71 ± .028
45	17.70 ± .069	17.92 ± .065	17.77 ± .016	18.02 ± .020	17.88 ± .057	18.17 ± .012
60	17.32 ± .016	17.82 ± .016	17.35 ± .024	17.88 ± .012	17.43 ± .012	17.97 ± .008
75	17.13 ± .053	17.31 ± .008	17.17 ± .016	17.35 ± .028	17.27 ± .012	17.55 ± .040
90	16.92 ± .021	17.10 ± .104	16.99 ± .016	17.19 ± .016	17.06 ± .028	17.26 ± .009

Table 2: Changes in total soluble solids content (⁰Brix) of papaya leather during storage as affected by levels of citric acid and packaging materials

Storage Period (days)	PSC _{0.5}		PSC _{0.75}		PSC _{1.0}	
	PET JAR	GLASS JAR	PET JAR	GLASS JAR	PET JAR	GLASS JAR
Fresh	64.29 ± .042	64.29 ± .034	64.23 ± .028	64.23 ± .057	64.19 ± .062	64.19 ± .028
15	64.54 ± .020	64.61 ± .016	64.50 ± .016	64.56 ± .012	64.45 ± .012	64.49 ± .065
30	65.31 ± .016	65.53 ± .013	65.21 ± .025	65.46 ± .020	65.15 ± .012	65.32 ± .021
45	66.34 ± .024	66.57 ± .029	66.23 ± .017	66.45 ± .033	66.18 ± .027	66.40 ± .025
60	67.35 ± .025	67.44 ± .028	67.25 ± .017	67.38 ± .020	67.22 ± .032	67.31 ± .013
75	68.30 ± .017	68.38 ± .020	68.24 ± .032	68.33 ± .022	68.21 ± .021	68.29 ± .032
90	70.07 ± .029	70.10 ± .021	69.83 ± .013	69.96 ± .032	69.61 ± .032	69.67 ± .024

Table 3: Changes in pH content of papaya leather during storage as affected by levels of citric acid and packaging materials

Storage Period (days)	PSC _{0.5}		PSC _{0.75}		PSC _{1.0}	
	PET JAR	GLASS JAR	PET JAR	GLASS JAR	PET JAR	GLASS JAR
Fresh	3.80 ± .040	3.80 ± .004	3.77 ± .012	3.77 ± .36	3.73 ± .012	3.73 ± .009
15	3.78 ± .008	3.79 ± .020	3.74 ± .016	3.72 ± .012	3.71 ± .017	3.67 ± .017
30	3.74 ± .016	3.69 ± .028	3.71 ± .012	3.67 ± .028	3.67 ± .016	3.64 ± .012
45	3.69 ± .008	3.66 ± .012	3.66 ± .021	3.64 ± .008	3.62 ± .020	3.62 ± .013
60	3.63 ± .009	3.61 ± .036	3.61 ± .012	3.59 ± .008	3.60 ± .016	3.59 ± .012
75	3.60 ± .016	3.56 ± .012	3.60 ± .020	3.56 ± .020	3.58 ± .029	3.55 ± .016
90	3.58 ± .016	3.54 ± .013	3.56 ± .009	3.52 ± .024	3.55 ± .041	3.50 ± .020

Table 4: Changes in optical density content of papaya leather during storage as affected by levels of citric acid and packaging materials

Storage Period (days)	PSC _{0.5}		PSC _{0.75}		PSC _{1.0}	
	PET JAR	GLASS JAR	PET JAR	GLASS JAR	PET JAR	GLASS JAR
Fresh	0.050 ± .012	0.050 ± .008	0.049 ± .021	0.049 ± .004	0.047 ± .0012	0.047 ± .012
15	0.052 ± .020	0.052 ± .008	0.050 ± .004	0.051 ± .004	0.048 ± .012	0.048 ± .016
30	0.054 ± .014	0.056 ± .021	0.052 ± .016	0.053 ± .024	0.050 ± .020	0.051 ± .028
45	0.056 ± .028	0.059 ± .017	0.054 ± .021	0.056 ± .024	0.052 ± .020	0.054 ± .031
60	0.059 ± .018	0.063 ± .008	0.057 ± .012	0.060 ± .016	0.055 ± .021	0.058 ± .028
75	0.061 ± .024	0.065 ± .016	0.059 ± .032	0.062 ± .013	0.057 ± .011	0.060 ± .019
90	0.064 ± .019	0.069 ± .024	0.062 ± .021	0.065 ± .027	0.061 ± .028	0.063 ± .017

Table 5: Changes in Vitamin-C content (mg/100g) of papaya leather during storage as affected by levels of citric acid and packaging materials

Storage Period (days)	PSC _{0.5}		PSC _{0.75}		PSC _{1.0}	
	PET JAR	GLASS JAR	PET JAR	GLASS JAR	PET JAR	GLASS JAR
Fresh	58.75 ± .079	58.75 ± .085	57.30 ± .074	57.30 ± .065	56.40 ± .072	56.40 ± .077
15	57.55 ± .068	57.65 ± .077	56.15 ± .072	56.25 ± .073	55.25 ± .062	55.40 ± .028
30	56.40 ± .028	56.45 ± .019	55.05 ± .018	55.10 ± .012	54.20 ± .024	54.35 ± .020
45	54.85 ± .021	55.25 ± .029	53.80 ± .016	54.00 ± .020	53.05 ± .036	53.80 ± .028
60	53.35 ± .019	54.05 ± .024	52.45 ± .036	52.90 ± .018	52.80 ± .025	51.80 ± .032
75	51.45 ± .016	53.80 ± .038	51.20 ± .028	51.40 ± .031	51.00 ± .017	50.95 ± .024
90	50.35 ± .029	51.40 ± .032	49.20 ± .022	50.20 ± .018	48.85 ± .016	49.05 ± .026

Table 6: Change in overall acceptability of papaya leather as affected by citric acid levels and packaging materials of fresh and stored papaya leather

Storage Period (days)	PSC _{0.5}		PSC _{0.75}		PSC _{1.0}	
	PET JAR	GLASS JAR	PET JAR	GLASS JAR	PET JAR	GLASS JAR
Fresh	7.352 ± .14	7.352 ± .14	7.585 ± .25	7.585 ± .25	7.282 ± .165	7.282 ± .165
30 days	7.31 ± .012	7.335 ± .004	7.492 ± .016	7.535 ± .032	7.26 ± .073	7.28 ± .015
60 days	7.287 ± .032	7.312 ± .020	7.462 ± .070	7.512 ± .042	7.222 ± .014	7.225 ± .016
90 days	7.222 ± .030	7.277 ± .045	7.415 ± .012	7.457 ± .032	7.162 ± .024	7.21 ± .018

PSC_{0.5}=Papaya Sugar 0.5% Citric acid levelPSC_{0.75}=Papaya Sugar 0.75% Citric acid levelPSC_{1.0}=Papaya Sugar 1.0% Citric acid level