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Storage Stability of Yellow Passion Fruit Juice

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Abstract—*The term 'passion fruit' exclusively represents the species, Passiflora edulis Sim consisting of purple fruited (P. edulis Sim) and yellow fruited (P. edulis f. flavicarpa Deg). The unique flavour of passion fruit is attributed to several volatile compounds which get deteriorate with increase in temperature as it is susceptible to oxidation. Thus, present study was undertaken with a view to assess the storage stability of passion fruit juice with preservative to retain quality near to natural.*

Passion fruit juice treated with sodium benzoate could be stored up to 90 days under refrigerated condition and up to 60 days under ambient condition. The microbial load was minimum in juice treated with 1.0 percent sodium benzoate as compared to 0.5 percent sodium benzoate. Among the treatment, lowest microbial population of bacteria 2.19×107 cfu per ml and yeast 2.87 ×105 cfu per ml was recorded under refrigerated condition. Though microbial population was low in 1.0% sodium benzoate treated juice, there was a deterioration of natural flavour of passion fruit juice during storage. The passion fruit juice treated with 0.5 percent sodium benzoate had higher microbial population than that of 1.0 percent sodium benzoate but it was within the permissible limit. Thus an inference can be drawn from the present study that passion fruit juice can be safely stored up to 90 days with preservative (0.5 % sodium benzoate) under refrigerated condition with acceptable quality having vitamin A content of 1.39 I.U.

1. INTRODUCTION

The term 'passion fruit' exclusively represents the species, *Passiflora edulis* Sim consisting of purple fruited (*P. edulis* Sim) and yellow fruited (*P. edulis f. flavicarp*a Deg). Passion fruit juice is very popular because of its unique strong aromatic flavour and amazing nutritional and medicinal properties. It also provides a good source of nutrients such as Vitamin C (18.2 mg/100g), Vitamin A (2410 I.U.), potassium (278mg/ 100g) and non-nutritive phytochemicals, carotenoids and polyphenols (435mg/100 l). Vitamin A can be obtained directly from the diet or derived from non-nutritive phytochemicals called carotenoids. In addition to being a vitamin A precursor, certain carotenoids such as β-carotene were found to have anticancer properties.

Passion fruit juice is mainly used in the preparation of diluted sweetened beverages, and processed as jam, jelly and marmalades. The juice of passion fruit maintained its colour, aroma and tastes for at least one month when 3 per cent benzoic acid is used as preservative [1]. This shows that benzoic acid is capable of inhibiting the microbial activities. The passion fruits on its own under room temperature remain in good condition for about five days without spoilage. Passion fruit is acidic in nature with unique flavour, which is not preferred for fresh consumption as natural juice but it is consumed by making sweeten juice. This unique flavour is attributed to several volatile compounds which get deteriorated with the increase in temperature. The main problem in preservation of passion fruit juice by heat preservation is the loss of heat sensitive flavour, which is susceptible to quick oxidation.

Thus, present study was undertaken with a view to assess the storage stability of passion fruit juice with preservative to retain quality near to natural.

2. MATERIALS AND METHODS

The experiment on Storage stability of Yellow passion fruit juice was conducted in the laboratory of the Department of Horticulture and Plant Pathology, B.N. College of Agriculture, Assam Agricultural University, Biswanath Chariali, Sonitpur during 2013-14.

The passion fruits were washed thoroughly, were cut into two halves and scooped out the pulp with the help of spoon from each half and rubbed vigorously in strainer and strained through stainless steel sieve. The extracted juices were treated with preservative and stored for 6 months. Treatments were P_0: without preservatives, P_1: with 0.5% sodium benzoate, P_2: with 1% sodium benzoate and two storage condition such as ambient condition and refrigerated condition. During storage bio-chemical analysis were done at 15 days interval and 30 days interval for microbial study. Observation on biochemical parameters like, ascorbic acid, vitamin A and microbial count were taken during the storage period.

Vitamin A was determined in terms of Beta Carotene. Five ml of juice was taken in a separating funnel and 10 ml of acetone and petroleum ether was added respectively and mixed it thoroughly. Discarded the lower layer and collected the upper layer and made up the volume up to 100 ml with petroleum ether. The record was taken by using spectrophotometer at 452 nm optical density (O.D.) using petroleum ether as blank. The

amount of vitamin A was calculated by the following formula and expressed in I.U. [8]

$$\beta \text{ Carotene } (\mu g / 100g) = \frac{O.D. \times 13.9 \times 104 \times 100}{\text{wt. of the sample} \times 560 \times 1000}$$

$$\text{Vitamin A (I.U.)} = \frac{\text{Beta carotene } (\mu g / 100g)}{0.6}$$

3. MICROBIOLOGICAL STUDY

Quality of the juice depends on its physico-chemical characteristics and microbial contamination. Juice extracted from passion fruit is acidic in nature. The high moisture content is responsible for the growth of yeast and bacteria. The normal changes expected in raw fruit juices at room temperature are an alcoholic fermentation by yeast followed by the oxidation of alcohol if acetic acid bacteria are present. Thus to increase the storability of the juice chemical preservative was used for inhabiting the microbial contamination.

Rose Bangle Agar, Potato Dextrose Agar and Nutrient agar media were used for yeast, mould and bacteria respectively. All the components of the individual medium were dissolved in 1 litre of distilled water in a conical flask and mixed thoroughly. Each medium was divided into 4 parts in 250 ml conical flasks. The flasks were tightly plugged with cotton and sterilized in autoclave at 15 psi (121^0C) for 15 minutes.

Serial dilution technique was used for inoculation of the samples. Serial dilution from 10^{-1} to 10^{-9} was prepared in sterile water and out of that 10^{-3}, 10^{-4}, 10^{-5} dilutions were used for yeast and mould and 10^{-7}, 10^{-8}, 10^{-9} dilutions were used to study the bacteria..

Inoculated petri plates were incubated in BOD (Biological Oxygen Demand) incubator at a temperature of 25 $\pm 20^0$ C and colonies were counted at an interval of 24 hours for 6 days. The final microbial population was calculated with the following formula

$$\text{cfu /ml} = \frac{\text{Total numbers of colonies observed}}{\text{Volume taken} \times \text{Dilution}}$$

4. RESULTS AND DISCUSSION

The data presented in Table 1 showed a gradual declining trend in Vitamin A content during storage. Among the treatments, highest Vitamin A (1.55 IU) was found in juice treated with 0.5% sodium benzoate and lowest (1.03 I.U.) in control (without preservative) during the storage period. Sodium benzoate might have played a role in stabilizing the beta carotene, since that was the only difference between the treatments. The decrease in vitamin A content might be due to oxidation of other arotenoids present in the juice. The percent decrease in Vitamin A content was more in ambient condition than that of refrigerated condition. This might be due to photosensitive nature of Vitamin A and also due to higher temperature coupled with photo-oxidation under ambient condition. This finding was in conformity with the earlier works in carrot pulp [3] and in papaya nectar [2]. The interaction between the chemical treatments and storage conditions showed significant difference in Vitamin A content of the passion fruit juice at both the storage condition. The maximum vitamin A (1.59 IU) retention was found in sodium benzoate treated juice under refrigerated conditions

Evaluation of microbiological population

The microbial population in passion fruit juice in relation to treatment and storage condition are presented in Table 2. Fresh juice contained maximum population of yeast (3.89×10^5 cfu per ml), bacteria (2.76×10^7 cfu per ml). The yeast and bacteria count after 1 month of storage was minimum in juice treated with 1 percent sodium benzoate (2.75×10^5 cfu per/ml and 2.01×10^7 cfu/ml) under refrigerated condition as compared to ambient condition. At the end of the storage minimum growth of yeast and bacteria was found in juice treated with 1.0 percent sodium benzoate (2.87×10^5cfu/ml and 2.68×10^7 cfu/ml) as compared to juice treated with 0.5 percent sodium benzoate (3.01×10^5cfu/ml and 2.68×10^7 cfu/ml). This might be due to better antimicrobial effect of sodium benzoate [7]. Partially pasteurized mango pulp treated with KMS, 500 ppm sodium benzoate was found to be effective against microorganisms and no colonies were formed up to 90 days of storage [5].

Minimum numbers of yeast and bacterial colonies were observed in juice which was stored in refrigerated condition as compared to ambient condition. Similar observation was also reported by [4]. The rate of microbial growth was slow under refrigerated condition as compared to ambient condition. Storage conditions and treatments might have checked the growth of microorganism under refrigerated condition. This result is in agreement with the findings of [6] in apple.

Passion fruit juice could be stored up to 90 days with sodium benzoate under refrigerated condition and up to 60 days under ambient condition. Though microbial population was low in 1.0% sodium benzoate, there was a deterioration of natural flavour of passion fruit juice during storage. The passion fruit juice treated with 0.5 percent sodium benzoate had higher microbial population than that of 1.0 percent sodium benzoate but it was within the permissible limit. Thus a conclusion can be drawn from the present study that passion fruit juice can be safely stored up to 90 days with preservative (0.5 % sodium benzoate) under refrigerated condition with acceptable physio-chemical quality. The acceptability of the products prepared from the stored juice by the panel members confirmed that minimum changes which might have occurred due to bacteria and yeast count were in safe limits for consumption.

Table 1: Effect of treatment and storage condition on vitamin A (I.U.) content of passion fruit juice during storage

Treatment	Storage condition		
	S_1	S_2	Mean
Fresh juice	1.59	1.59	1.59
AFTER 15 DAYS STORAGE			
P_0 (without preservative)	1.21	1.31	1.26
P_1 (0.5% sodium benzoate)	1.51	1.59	1.55
P_2 (1% sodium benzoate)	1.47	1.59	1.53
Mean	1.39	1.49	
CD (5%) S = 0.03 P = 0.047 S×P = 0.081			
AFTER 30 DAYS STORAGE			
P_0 (without preservative)	-	1.03	1.03
P_1 (0.5% sodium benzoate)	1.39	1.58	1.48
P_2 (1% sodium benzoate)	1.34	1.56	1.45
Mean	1.36	1.39	
CD(5%) S = 0.030 P = 0.037 S×P = 0.064			
AFTER 45 DAYS STORAGE			
P_0 (without preservative)	-	0.75	0.75
P_1 (0.5% sodium benzoate)	1.25	1.56	1.40
P_2 (1% sodium benzoate)	1.19	1.51	1.35
Mean	1.22	1.27	
CD(5%) S = 0.041 P = 0.050 S×P = 0.088			
AFTER 60 DAYS STORAGE			
P_0 (without preservative)	-	-	-
P_1 (0.5% sodium benzoate)	1.07	1.53	1.30
P_2 (1% sodium benzoate)	0.98	1.43	1.20
Mean	1.02	1.48	
CD(5%) S = 0.035 P = 0.043 S×P = 0.075			
AFTER 75 DAYS STORAGE			
P_0 (without preservative)	-	-	-
P_1 (0.5% sodium benzoate)	-	1.47	1.47
P_2 (1% sodium benzoate)	-	1.31	1.31
Mean	-	1.39	
CD(5%) S = 0.024 P = 0.029 S×P = 0.051			
AFTER 90 DAYS STORAGE			
P_0 (without preservative)	-	-	-
P_1 (0.5% sodium benzoate)	-	1.39	1.39
P_2 (1% sodium benzoate)	-	1.16	1.16
Mean	-	1.27	
CD(5%) S = 0.017 P = 0.021 S×P = 0.036			

P = Preservative, S_1 = Room condition,
S_2 = Refrigerated condition

Table 2: Effect of treatments and storage condition on Bacteria and Yeast population in passion fruit juice during storage

Storage periods	Storage conditions	Treatments	Bacteria cfu/ml	Yeast cfu/ml
Fresh sample			2.76×10^7	3.38×10^5
1 month	S_1	P_0 (without preservative)	5.26×10^7	6.92×10^5
		P_1 (0.5 % sodium benzoate)	3.46×10^7	3.87×10^5
		P_2 (1.0 % Sodium benzoate)	3.21×10^7	3.69×10^5
	S_2	P_0 (without preservative)	4.62×10^7	5.74×10^5
		P_1 (0.5 % sodium benzoate)	2.05×10^7	2.98×10^5
		P_2 (1.0 % Sodium benzoate)	2.01×10^7	2.75×10^5
2 months	S_1	P_0 (without preservative)	-	-
		P_1 (0.5 % sodium benzoate)	3.69×10^7	4.12×10^5
		P_2 (1.0 % Sodium benzoate)	3.32×10^7	4.01×10^5
	S_2	P_0 (without preservative)	-	-
		P_1 (0.5 % sodium benzoate)	2.05×10^7	2.68×10^5
		P_2 (1.0 % Sodium benzoate)	1.89×10^7	2.37×10^5
3 months	S_1	P_0 (without preservative)	-	-
		P_1 (0.5 % sodium benzoate)	-	-
		P_2 (1.0 % Sodium benzoate)	-	-
	S_2	P_0 (without preservative)	-	-
		P_1 (0.5 % sodium benzoate)	2.68×10^7	3.01×10^5
		P_2 (1.0 % Sodium benzoate)	2.19×10^7	2.87×10^5

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