Studies on Preservation of Sugarcane Juice

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Abstract - The present investigation entitled "Studies on Preservation of Sugarcane Juice" was undertaken to study the chemical properties and storage life of sugarcane juice at department of Agricultural Process Engineering, K. K. Wagh college of Agril. Engg.& Technology, Nashik. Sugarcane samples were prepared by using different preservatives namely Potassium meta-bisulphite (KMS), Citric acid, Lemon, Ginger, Black salt and different packaging materials like Glass bottle, PET bottle and LDPE Pouches and then Samples were stored at refrigeration temperature (4 ± 2ºC) for 30 days. Samples were evaluated for chemical and sensory changes at an interval of 10 days. The fresh sample contains pH 5.28 to 5.52, TSS 18.00 to 19.50 ºBrix. The other parameters like total sugar, reducing sugar and acidity ranged from 17.60 to 19.10, 0.24 to 0.64 and 0.24 to 0.39 respectively. During storage period pH, Total sugar (%) and TSS (ºBrix) decreases from 4.9 to 3.6, 20.9 to 19.3 and 20.3 to 17.2 resp. On the other hand acidity (%) and reducing sugar (%) increases from 0.08 to 0.28 and 0.53 to 0.75 resp. Considering the chemical and sensory properties after 30 days best sample was found in glass bottle containing KMS (225 ppm) + lemon (3ml/100ml)+ Ginger (0.6ml/100ml) + Black salt (0.5gm/100ml)

Keywords: Sugarcane juice, preservatives, packaging materials

I. INTRODUCTION

Sugarcane is an important industrial crop cultivated in tropical and subtropical regions of the world. India is the world second largest producer of sugarcane next to Brazil. Sugarcane has been used as a sweetener for millennia and today refined sugar is used in copious quantities to supplement the natural sugar (fructose) found in fruits and vegetables (Phanikumar, 2011). Sugarcane juice is a type of drink commonly found in Southeast Asia, South Asia and Latin America and also in other countries where sugarcane is grown commercially. Sugarcane juice is very popular delicious drink and it is rarely available commercially in packaged form. It is extracted by crushing sugarcane between roller crusher and consumed with (or) without ice. Sugarcane juice contains water (75 to 85%), non reducing sugars (sucrose, 10 to 21%), reducing sugars (glucose and fructose, 0.3 to 3%), organic substances (0.5 to 1), inorganic substances (0.2 to 0.6) and nitrogenous bodies (0.5 to 1) (Swaminathan, 1995). In general sugarcane juice is spoiled quickly by the presence of simple sugars. The sugarcane juice can be introduced as delicious beverages by preventing the spoilage of juice with appropriate method. Soon after the harvest of sugarcane; endogenous invertase enzyme is activated and acts as a cause of deterioration. These organisms convert sucrose into polysaccharides, such as dextran. Besides, loss of sucrose, the presence of dextran even in very small amount creates problem of filtration, clarification, crystallization and alters the shape of sugar crystals thereby affecting the quality of sugar (Krishnakumar and Devadas, 2006). Keeping this factor in view, the present study was under taken with following objectives.

Objectives:

1. To study the chemical properties of sugarcane juice
2. To study the storage life of sugarcane juice using preservatives and different packaging material.

II. SYSTEM MODEL

3.4 Process flow chart

3.4.1 Process for sugarcane extract

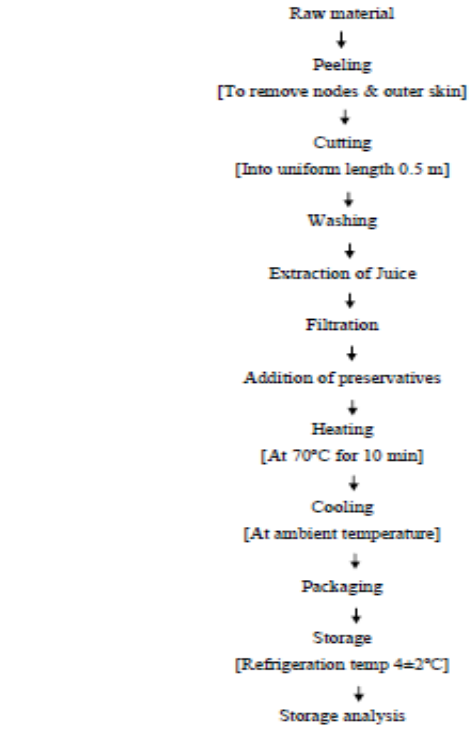

Figure3.1. Process for sugarcane extract

III. PREVIOUS WORK

Chauhan *et al.* (2002) were studied the preservation of sugarcane juice by pasteurizing at 70ºC for 10 minutes and adding citric acid (40 mg/100ml), ascorbic acid (40 mg/100ml) and potassium metabisulphite (150

ppm).Samples of sugarcane juice beverage were stored at room (30 ± 5ºC) and refrigeration (4 ± 2ºC) temperature in pre-sterilized glass bottles and analyzed for physico-chemical, microbiological and sensory attributes at every 15 days interval for 90 days. The sugarcane juice beverage having citric acid and potassium metabisulphite showed minimum changes in sensory qualities during storage both at room and refrigeration temperature for 90 days.

Karmakar *et al.* (2010) studied the effect of temperature on the rates of decomposition of Vitamin-C and destruction of microorganisms in sugarcane juice during pasteurization, followed by packaging in flexible packs. Pasteurization of 30 conical flasks which contained 100 ml of sugarcane juice per flask at different temperatures, for different time intervals were studied keeping the flasks under two different conditions such as refrigerated temperature (4°C) and room temperature (30°C). Another set of experiments were carried out by adding sodium meta bisulphite (preservative) at two concentrations; 500 ppm and 1000 ppm.

Khare *et al.* (2012) examined the preservation of sugarcane juice using potassium mete bisulphite (KMS), spices and mild heat treatment at different combinations under refrigeration temperature. Good quality beverage from sugarcane juice of variety Cos 767 with satisfactory storage stability of 60 days at refrigeration could be prepared from heat treated juice at 75ºC for 10 min after addition of 3.0 ml lemon as flavour enhancer and source of citric acid (anti oxidant) and 1.0 gm salt as flavouring compound, 0.6 ml ginger as flavour enhancer per 100 ml of sugarcane juice.

Sangeeta *et al.* (2013) was studied the preservation of sugarcane juice blended with different proportions of anola juice. These selected juice blends were thermally treated at different temperatures (60, 70 and 80°C) for different intervals of time (5, 10 and 15 minutes) and best temperature-time combination selected on the basis of sensory score was 70°C for 10 minutes.

IV. PROPOSED METHODOLOGY

All the treatments of juice were stored for 30 days at refrigeration temperature 4±2ºC. Samples were drawn and analyzed for physico-chemical and sensory attributes at an interval of 10 days.

Table 1. Treatment details

Treatments	Details
T1	Glass bottles + KMS(150 ppm)
T2	Glass bottles + Citric acid (40mg/100ml) + KMS (150 ppm)
T3	Glass bottles + KMS (225 ppm) + lemon (3ml/100ml) + Ginger (0.6ml/100ml) + Black salt (0.5gm/100ml)
T4	PET Bottle + KMS(150 ppm)
T5	PET Bottle+ Citric acid (40mg/100ml) + KMS (150 ppm)
T6	PET Bottle+ KMS (225 ppm) + lemon (3ml/100ml) + Ginger (0.6ml/100ml) + Black salt (0.5gm/100ml)
T7	LDPE Pouch+ KMS(150 ppm)
T8	LDPE Pouch+ Citric acid (40mg/100ml) + KMS (150 ppm)
T9	LDPE Pouch+ KMS (225 ppm) + lemon (3ml/100ml) + Ginger (0.6ml/100ml) + Black salt (0.5gm/100ml)

a) Raw Material

Sugarcane was procured from the local whole sale market of Nasik. Sugarcane selected were healthy green, free from visible decay, tops and crash.

b) Washing and cleaning

Samples were washed by running tap water to get sugarcane free from any dust and dirt. Then skin and node of sugarcane stem were removed with the help of curved blade knife.

c) Extraction of juice

Sugarcane juice were extracted by compact sugarcane extractor and filtered through the muslin cloth to remove the extraneous matter.

d) Addition of preservatives

Addition of preservatives such as KMS, citric acid, lemon and ginger as per the treatment details in sugarcane juice immediately after extraction of juice.

e) Heating

After addition of preservatives in the different samples, the sugarcane juice is heated at 70˚c for 10 minutes in water bath.

f) Cooling

The samples were cooled at room temperature for 15-20 min after heating procedure.

g) Packaging

After cooling the samples, the samples were packed in three different packaging materials such as glass bottle, LPDE Pouches, PET bottles. Corking machine was used for corking glass bottle and sealing machine was used for sealing LDPE pouches.

h) Storage

Sugarcane juice samples were stored at 4˚C in refrigerator for 10 day, 20 days and 30 days.

Lemon juice extraction:

Lemons were cut into two pieces with the help of sharp blade knife. Then lemon pieces were squeezed by hand and lemon extract was filtered through the muslin cloth to remove the extraneous matter and seeds.

Ginger juice extraction:
Gingers were peeled with the help of sharp knife. Then peeled ginger pieces were cut into small pieces. Then ginger extract was extracted by putting into muslin cloth and apply force to help in ease of extraction. After extraction the shreds of ginger were discarded.

Analysis of Samples:

The sample was analysed for chemical attributes at an interval of 10 days by the following parameters

a) **Reducing Sugar and Non Reducing Sugar**

The reducing sugars were determined by the volumetric method as reported by (Ranganna (1986).

b) **pH**
pH values were measured by Digital pH meter.

c) **Acidity**
Acidity was measured by titration method (Ranganna, 1986).

d) **TSS**
Total soluble Solids were measured by using Hand Refractometer.

Sensory evaluation:

Sensory evaluation consists of judging the quality of food by panel of judges. The evaluation deals with measuring analyzing and interpreting the quality of food, as they are perceived by a sense of sight, taste and touch. By the sense of sight, the size, shape & colour of food & other characteristics such as transparency, opaqueness, turbidity, dullness and gloss can be perceived. Colour of the foods contributes immeasurably to once appreciation of them. In addition, colour is associated with other attributes.

V. SIMULATION/EXPERIMENTAL RESULTS

The results obtained in experiments are presented and discuss in this chapter.

Chemical composition of fresh sugarcane juice:
Chemical composition of fresh sugarcane juice was evaluated and presented in table given below.

Table 2. Chemical composition of fresh juice

Sr.no.	Characteristics	Value
1	pH	4.35
2	Acidity (%)	0.128
3	Total sugar (%)	18.60
4	Reducing sugar (%)	0.24
5	TSS (°Brix)	20.00

Changes in chemical composition of sugarcane juice during storage period

The chemical composition of all the treatments was evaluated at 10 days interval over the storage period of 30 days. The results obtained are present below under suitable headings.

Acidity:

The data of change in acidity of sugarcane juice is presented in table 3. The data indicates that, Acidity increases as storage period increases. Acidity of sugarcane juice varies from 0.08% to 0.28%. lowest acidity was found in treatment T3 followed by T7. Same results were obtained by (Chauhan *et al* 2002).

Table 3. Changes in acidity of sugarcane juice during storage period

Treatments	10 Days	20 Days	30 Days
T1	0.16	0.18	0.26
T2	0.12	0.13	0.15
T3	0.08	0.09	0.12
T4	0.08	0.10	0.16
T5	0.20	0.22	0.24
T6	0.20	0.22	0.24
T7	0.08	0.10	0.14
T8	0.16	0.20	0.22
T9	0.20	0.20	0.28

pH

The data of change in pH of sugarcane juice is presented in table 4. The data indicates that, pH value decreases as storage period increases. pH value of sugarcane juice

varies from 3.6 to 4.9. pH value was found best in treatment T3 followed by T4. Same results were obtained by (Chauhan *et al*, 2002).

Table 4. Changes in pH of sugarcane juice during storage period

Treatments	10 Days	20 Days	30 Days
T1	4.90	4.80	4.60
T2	4.81	4.40	4.20
T3	4.72	4.10	3.90
T4	4.90	4.90	4.70
T5	4.90	4.28	4.00
T6	4.45	3.90	3.60
T7	4.90	4.70	4.40
T8	4.70	4.50	4.50
T9	4.42	4.40	4.14

Total sugar (%):

The data of change in Total sugar (%) of sugarcane juice is presented in table 5. The data indicates that, Total sugar (%) decreases as storage period increases. Total sugar (%) of sugarcane juice varies from 19.3 to 20.9.Total sugar (%) was found best in treatment T3 followed by T7. Same results were obtained by (Chauhan *et al*, 2002).

Table 5. Changes in Total sugar (%) of sugarcane juice during storage period

Treatments	10 Days	20 Days	30 Days
T1	20.7	20.5	20.3
T2	20.9	20.4	20.2
T3	19.9	19.7	19.5
T4	20.6	19.9	19.6
T5	20.8	20.5	20.3
T6	20.7	20.6	20.5
T7	20.5	19.8	20.3
T8	20.9	20.4	20.2
T9	20.5	20.5	20.3

Reducing sugar (%):

The data of change in reducing sugar (%) of sugarcane juice is presented in table 6. The data indicates that reducing sugar (%) increases as storage period increases. Reducing sugar (%) of sugarcane juice varies from 0.53 to 0.75. Reducing sugar (%) was found best in treatment T1 followed by T7.Same results were obtained by (Chauhan *et al*, 2002).

Table 6. Changes in reducing sugar (%) of sugarcane juice during storage period

Treatments	10 Days	20 Days	30 Days
T1	0.54	0.72	0.75
T2	0.56	0.67	0.69
T3	0.53	0.63	0.65
T4	0.55	0.71	0.73
T5	0.57	0.68	0.69
T6	0.54	0.62	0.64
T7	0.55	0.72	0.74
T8	0.57	0.66	0.67
T9	0.56	0.61	0.63

Total soluble solids (ºBrix):

The data of change in TSS (ºBrix) of sugarcane juice is presented in table 7. The data indicates that, TSS (ºBrix) decreases as storage period increases. TSS (ºBrix) of sugarcane juice varies from 17.2 to 20.3. Reducing sugar (%) was found best in treatment T3 followed by T6.

Table 7. Changes in Total soluble solids (ºBrix) of sugarcane juice during storage period

Treatments	10 Days	20 Days	30 Days
T1	20.0	19.9	19.4
T2	20.0	19.8	19.6
T3	19.0	19.0	18.8
T4	19.2	19.1	19.0
T5	19.1	19.0	18.9
T6	17.2	17.2	17.0
T7	20.3	20.1	19.1
T8	20.1	19.9	19.8
T9	17.4	17.4	17.2

Sensory Evaluation:-

Sensory evaluation of sugarcane juice, preserved for 10 days was carried out as shown in table 8. All samples were tasted by panel and the results were recorded by taking the reference of nine-point hedonic scale in which taste, colour, flavour and overall acceptability were tested. The results of preserved Sugarcane juice was recorded by sensory panel, then sample T3 (sugarcane juice + Glass

bottle + KMS + Lemon + Ginger) was found best with highest average score.

Table 8. Nine point hedonic scale showing the points as per the likeliness of sample

Treatments	Sensory score (9-point Hedonic scale)			
	Colour	Flavour	Taste	Overall acceptability
T1	6	7	7	6.66
T2	8.5	8	8	8.16
T3	9	8.5	8.5	8.66
T4	7	7	6	6.66
T5	8	8	7	7.66
T6	8	8	9	8.33
T7	6	7	7	6.66
T8	7	7	8	7.33
T9	8	9	8	8.33

VI. CONCLUSION

1. We can store sugarcane juice for 30 days by using different preservatives and packaging materials.

2. According to chemical analysis suitable acidity, reducing sugar and total sugar was found in T3 (sugarcane juice + Glass bottle + KMS + Lemon + Ginger).

3. According to sensory evaluation, colour, flavor, taste and overall acceptability score was higher for treatment T3 (sugarcane juice + Glass bottle + KMS + Lemon + Ginger).

VII. FUTURE SCOPES

The more precision work can be done on the storage of the Sugarcane juice by using this research work.

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