International Journal of Advance Research in Science and Engineering
Vol. No.9, Issue No. 07, July 2020
www.ijarse.com
IJARSE
ISSN 2319 - 8354

DEVELOPMENT AND PRESERVATION OF SUGARCANE JUICE

Amruta Ranaware[1], Rasika Mane[2],
Mr. Shital Patil[3] & Dr. A. K. Sahoo[4]
Department of Food Technology, Shivaji University, Kolhapur, India

ABSTRACT:

The lack of satisfactory utilization of solid normal squeezes and raising wellbeing constant infection came about the extension for growing new beverages. India is second biggest sugarcane created crop gives nutritious juice. The present work of creating and saving mixed sugarcane juice with basil, ginger and lemon separate with included dark salt with fluctuating extent gives greater agreeableness by semiskilled tangible board. Pretreatment of ascorbic acid corrosive with included sodium benzoate give cell reinforcements and additive impact which builds security of nourishment. The readied mixed sugarcane juice is filled in glass bottle sterilized at 80^{o}C for 10 minutes. The readied physico-chemical, sensorial and microbial properties were stable up to one month.

Keywords: Sugarcane juice, Preservation, Antioxidants, Pretreatment

1. INTRODUCTION:

Sugarcane is an important industrial crop cultivated in tropical and subtropical regions of the world. India is the second largest producer of sugarcane in the world. In 2014-15 the total production of sugarcane was around 359.33 million tones, producing nearly 273.07 million white sugar and 45.63 million tonesgur and khandsari (Anonymous, 2016b)[1]. Sugarcane juice of 100 ml provides 40 Kcal of energy, 10 mg of iron and 6 mg of carotene. It contains water (75%-85%), reducing sugar (0.3-3.0%), non-reducing sugar (10-21%) (Krishnakumar *et al.,* 2013)[2]

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. A part of sugarcane juice consumed as expensive and pleasing beverages in India. It possesses therapeutic value. (Banerji *et al.,* 1997)[3]

Sugarcane juice is rich in enzyme and possesses many medicinal and therapeutic properties. Sugarcane juice is very useful in scanty urination. It has been used to cure jaundice and liver-related disorders in Indian systems of medicine. According to Ayurveda, it is oleaginous, diuretic, tonic, cooling, aphrodisiac and useful in fatigue, thirst, anemia, ulcers etc., while according to the Unani system it is laxative, diuretic, aphrodisiac and good for lungs. However, the sugarcane juice gets spoiled quickly after crushing due to presence of simple sugars. Hygiene standards are usually not maintained during the transport of sugarcanes from field to the point

of extraction and preparation of juice. Further the juice is consumed unpasteurized; therefore, it is possible that the sugarcane juice gets contaminated and poses health hazards. (Karthikeyan and Samipillai, 2010).[4]

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. Biodegradation is caused by microorganisms mainly Leuconostoc sp. (L. mesenteroides and L. dextranium) also takes place. 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 *et. al.*, 2006).[5]

Medicinal plants are being used from the ancient times as the source of medicine and healing properties. They have nutraceuticals potential which makes it effective for use in any infection and disease according to the traditional concept of Ayurveda. Holy Basil (Ocimum sanctum) is one of the most widely grown herbs for therapeutic use. The herb is used as a remedy for a variety of conditions including the common cold, headaches, stomach disorders, heart disease, inflammation, malaria, various forms of poisoning, as well as spiritual and flavoring purposes. Recent studies suggest holy basil may be a (cyclooxygenase-2) COX-2 inhibitor like many modern painkillers, due to its high concentration of eugenol. (Kumar and Singh, 2016).[6]

Ginger (Zingiber officinale) has strong antibacterial and to some extent antifungal properties. In vitro studies have shown that active constituents of ginger inhibit multiplication of colon bacteria. It inhibits the growth of Escherichia coli, Proteus sp, Staphylococci, Streptococci and Salmonella (Rao P., 2000) [7]

Citrus fruits like mosambi and lemon are excellent sources of free citric acid, natural sugar, calcium and phosphorus. They are responsible for a series of health benefits. Beverages from fruits and vegetables are important in human diet.

2. OBJECTIVES:

a) Studying physico-chemical properties of raw material (sugarcane)
b) Optimizing the preservation process of sugarcane juice
c) Development of value added sugarcane juice with basil extract, ginger extract, lemon juice and black salt
d) To study shelf storage of sugarcane juice

3. MATERIALS:

Raw materials such as sugarcane juice, basil leaves, ginger, lemon, salt, ascorbic acid and sodium benzoate were procured from local market. Sugarcane of CO- 86032 variety is used. Graded sample were then washed under running tap water to make them free from any dust and dirt. Then skin and node of sugarcane stem were removed with the help of curved blade knife. Further the juice was extracted using a power operated screw extractor. The basil leaves and ginger were pressed in mortar pestle and filtered using muslin cloth to remove all extraneous matter from the extract.

4. METHODOLOGY:

4.1 Basil Extract:

Fresh basil leaves were pruned and leaves were washed under running water. Further, the leaves were crushed in mortal pestle. Little water is added for efficient extraction of extract. The extract is filtered using muslin cloth. Again, the remains are crushed under mortal pestle and the juice is extracted. The extracted juice is covered using parafilm.

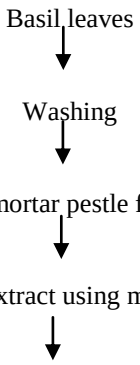

Figure No. 1 *Preparation of Basil extract*

4.2 Ginger Extract:

Gingers were peeled with the help of sharp blade knife. Then peeled ginger pieces were cut into small pieces. Then ginger extract was extracted by put into in muslin cloth and apply force in mortal and pastel, to help in ease of extraction. After that ginger extract were filtered through muslin cloth and shreds of ginger were discarded.

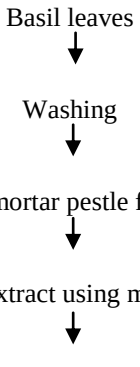

Figure No. 2 *Preparation of ginger extract*

4.3 Preparation of lemon extract:

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

Fresh Lemon

↓

Washing and Grading of Lemon

↓

Cut lemons into two halves

↓

Squeeze halved lemon with the help of squeezer

↓

Filter the lemon extract through screen

↓

Cleared lemon extract

Figure No. 3 *Preparation of Lemon extract [12]*

4.4 Preservation of sugarcane juice:

Sugarcane of Co-86032 variety was procured from local market of Kolhapur. Fresh sugarcane was used for the extraction of sugarcane juice. Graded sample were then 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. The outer layer of sugarcane stems is scrapped to lessen the microbial load. Further the stems were given an anti-oxidant treatment for 30mins. Sugarcane juice were extracted by power operated screw juice extractor and filtered through the sieve and muslin cloth to remove the extraneous matter. The process flow chart for sugarcane juice recovery is given in Figure no. 5

Sugarcane

↓

Removal outer layer

↓

Pretreatment of antioxidant (0.05gm/liter)

↓

Extraction of juice

↓

Pasteurization of juice (10 min at 80°C)

↓

Filtration (muslin cloth)

↓

Add basil leaves, ginger, lemon and black salt

↓

Addition of antioxidant (0.06gm/100 ml) and

preservative (0.014 gm/100ml)

↓

In –bottle pasteurization (3 min at 110°C)

↓

Cooling

↓

Storage (5°C)

Figure no. 4 *Recovery of sugarcane juice and stabilizing shelf life*

4.5 Optimization of attributes:

After the extraction of sugarcane juice, the basil extract, ginger extract, lemon extract and black salt blended sugarcane juice beverage formulation was done by the addition of sugarcane juice, basil extract, ginger extract, lemon extract and black salt in predetermined concentration as per the calculation made in Table no.1

Sr. No.	Concentrations	Sample A	Sample B	Sample C
1	Sugarcane juice (ml)	79	**69**	58
2	Pretreatment (gm)	0	**0.025**	0.050
3	Basil extract (ml)	15	**20**	25
4	Ginger extract (ml)	3	**5**	8
5	Lemon juice (ml)	2	**4**	6
6	Black salt (gm)	0.01	**0.02**	0.03
7	In-bottle Pasteurization (°C)	80	**90**	100

Table no.1 *Optimization of basil extract, ginger extract, lemon juice and black salt blended sugarcane juice beverage formulation per 100 ml of sugarcane juice*

Based on sensory evaluation, best combination was chosen. The healthy sugarcane juice was then filled in sterilized glass bottles. The bottles after being filled were loosely covered with tin crowns. The partially sealed glass bottles were exhausted at high temperature. After complete exhausting the glass bottle were sealed by double seamer and pasteurized. For the heat treatment purpose in bottle pasteurization method were used to heat treat the sample.

Optimization of shelf life was done based on physic-chemical, microbiological and sensory characteristic changes during the storage life of healthy sugarcane juice, were subjected to storage studies at refrigeration temperature for a period of one month by drawing samples for determination of changes in physico-chemical, microbiological and sensory evaluation (Ranganna, 2007)[8] at ten days intervals to evaluate changes in chemical and microbial parameters.

5. RESULT AND DISCUSSION:

5.1 Physico- chemical analysis of raw product such as sugarcane juice, basil extract and ginger extract:

Physico-chemical characteristics of raw juice without addition of extracts were analyzed. The juice content of sugarcane was found to be 51.8%. Similarly, the juice extracted in basil and ginger extract was found to be 30% and 21% resp. The TSS of juice was 19.5 (°Brix), which is higher than that found in the study of Krishnakumar and Devadas (2006). These variations in juice yield, and TSS might be attributed to cultivation process and crushing methods. All the chemical characteristics were also analyzed, the sugarcane juice is acidic in nature pH 4.35, vitamin C content were 1.25 mg/100 g. While the acidity of basil and ginger extract resp. were 0.10% and 0.07%. All analysis followed the procedure given by AOAC[9]. The analysis of this juice is given in Table no.2

Sr. no.	Characteristics	Sugarcane juice	Basil extract	Ginger extract
1	Juice yield (%)	51.8	30	21
2	TSS (°Brix)	19.5	16.6	14
3	Vitamin C (mg/100ml)	1.25	9	2.5
4	pH	4.35	5.2	6.5
5	Acidity (%)	0.128	0.10	0.07
6	Anti-oxidant activity	-	62.36	65.10

Table no.2 *Physico-chemical of raw sugarcane juice, basil and ginger extract*

5.2 Optimization of healthy sugarcane juice based on sensory analysis:

In the optimization of healthy sugarcane juice formulations, mainly the quantity of basil extract, ginger extract, lemon juice and black salt in sugarcane juice was optimized based on sensory evaluation using a Hedonic Test[10]. The sensory evaluation was based on six parameter color, appearance, consistency, taste, flavor and overall acceptability. For the optimization process different ratio of basil extract (15-25 ml), ginger extract (3-8ml), lemon juice (2-6 ml) and black salt (0.01-0.03 gm) were employed. The average score obtained by each ratio are given in table 5.2, in which the sample no. B [Basil extract (20ml), ginger extract (5ml), lemon juice (0.02gm)] obtained the best scores. This optimized beverage was used for shelf life study.

Attributes	Control Sample	Sample A	Sample B	Sample C
Color	8.5	7.6	**8.5**	8.1
Appearance	8.2	8	**8.3**	7.5
Consistency	8.3	7.4	**7.9**	7.3
Taste	8.8	8	**8.5**	8.1
Flavour	8.6	7.6	**8**	7.8
Overall Acceptability	9	7.5	**8.5**	8

Table no.3 *Sensory analysis of prepared beverage*

5.3 Physico-chemical changes during storage of sugarcane juice:

Changes in physico-chemical characteristics are shown in below Table. The total soluble solids (increased by 2%) during storage of sugarcane juice at refrigeration temperature, however, the increase was of lesser extent in sample B which contained 14ppm of sodium benzoate. The increase in total soluble solids is due to concentration of sugars during heat treatment and it is balanced because of conversion of sugars into acids during storage because of biochemical reactions in the juice. The content of reducing sugars in juice increased significantly during storage due to the hydrolysis of non-reducing sugars. Addition of lemon (ascorbic acid) to heat treated sugarcane juice beverage restricted the degradation of total soluble solids and total sugars during storage at refrigeration temperatures [11]. The pH increased whereas acidity decreased significantly during storage of sugarcane juice. Addition of sodium benzoate to juice reduced the microbial activity during storage resulting in significantly less addition in pH and less decrease in acidity specially in the beverage containing 100 ppm sodium benzoate.

Sr. no.	Characteristics	Final product
1	Juice content (%)	70
2	TSS (°Brix)	21.5
3	Vitamin C (mg/100ml)	2.6
4	Ph	5.4
5	Acidity (%)	0.105
6	Protein (%)	0.20
7	Vitamin C (mg/100ml)	2.69

Table no.4 *Physico-chemical of prepared sugarcane juice product*

5.4 Microbial changes during storage of sugarcane juice:

Total Plate Count (TPC) test was performed periodically at every 10 days interval. The bacteria, yeast and mold population increased during storage of sugarcane juice. The least growth was observed in the initial days whereas highest growth was observed in later stage. The Total plate count on 31st day as beyond the limit and hence the sample is discarded. The data for microbiological changes id shown in table no.5 below.

Microbial Test	**Number of Days**				
	0	**10**	**20**	**30**	**31**
TPC x10^3 (cfu/ml)	0.01	2.3	5.7	9.2	SD
Y&M x10^2 (cfu/ml)	ND	1.8	5.3	8.2	SD

Table no.5 *Changes in Yeast and Mold Count (YMC) and Total plate count during storage*

Note:

ND: Not detected

SD: Sample discarded

6. CONCLUSION:

On the basis of facts stated above it may be concluded that good quality beverage from sugarcane juice of variety Co-86032 with satisfactory storage stability of 30 days at refrigeration could be achieved from heat treated sugarcane juice beverage at 80°C for 10 min after addition of 20ml of basil extract as a medicinal herb, 5 ml of ginger extract and 4.0 ml lemon as flavour enhancer and 0.02 gm black salt as flavoring compound per 69ml of sugarcane juice. The formulation is made for 100ml of healthy sugarcane juice. Sodium benzoate added at 14ppm exhibited the best anti-microbial activity. The ginger juice acts as natural antimicrobial agent hence this gave a preservative action and inhibited the growth of micro-organism during storage. Sodium benzoate is also a known yeast and mold inhibitor and is being used widely for the preservation of foods.

REFERENCES:

[1] Anonymous (2016a). Sugarcane, sugar and molasses production at a glance. Co-operative Sugar, 47(7):42 Anonymous (2016b). Utilization of sugarcane for different purposes. Co-operative Sugar, 47(7):47

[2] Krishnakumar, T., Thamilselvi, C. and Devadas, C.T. (2013). Effect of delayed extraction and storage on quality of sugarcane juice. African J. Agric. Res., 8(10): 930-935.

[3] Banerji,R., Madan,V.K. and Misra, S.R. (1997). Preservation of sugarcane juice. Indian Sugar, 47(3):195-200.

[4] Karthikeyan, J. and Samipillai, S.S. (2010). Sugarcane in therapeutics.J. Herbal Med. & Toxicol., 4 (1): 9-14.

[5] Krishnakumar, T. and Devadas, C.T. (2006). Biochemical changes in sugarcane juice during storage in different packaging materials. Processed Food Industry: 11-17.

[6] Kumar, D. and Singh, P. (2016). Effect of some Indian herbs and chemical on shelf-life of sugarcane juice.Asian J. Hort., 11(1): 187-193.

[7] Rao, P., Reddy, M.S., Ra, P.N., Narendranath, V.V.; Reddy, G.L.N. Juice Quality and Mineral Nutrient Status in Red Rot Infected Canes. Indian Sugar. 1984, 34 (8), 6157620.

[8] Ranganna, S. (2007). Hand book of analysis and quality control for fruit and vegetable products (2nd Ed.).TataMcGraw Hill Publ Co. Ltd. New Delhi, pp. 1, 12-16, 105-106.

[9] AOAC. 1984. Official Methods of Analysis, 14 editions Association of Official Analytical Chemists, Washington D.C.

[10] Gatti, E., Di Virgilio, N., Magli, M., & Predieri, S. (2011). Integrating sensory analysis and hedonic evaluation for apple quality assessment. *Journal of Food Quality*, *34*(2), 126-132.

[11] O. P. Chauhan, Dheer Singh, S. M. Tyagi & D. K. Balyan (2002) STUDIES ON PRESERVATION OF SUGARCANE JUICE, International Journal of Food Properties, 5:1, 217-229, DOI: 10.1081/JFP-120015603

[12] Khare, A., Behari Lal, A., Singh, A., & Pratap Singh, A. (2012). Shelflife enhancement of sugarcane juice. Hrvatski časopis za prehrambenu tehnologiju, biotehnologiju i nutricionizam, 7(3-4), 179-183.