Research Article

Quality Properties of Wine from Three Varieties of North Indian Guava Fruit

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Abstract

Several domestic varieties of guava fruit including Allahabad Safeda, Chittidar and Punjab Pink were utilized for the processing of wines. Guava fruit wines were analyzed for TSS, ethanol content, acidity and pH. The total soluble solid content of the guava fruit juice was ameliorated to 20 degrees brix using sugar solution and was fermented for 30 days at 22±2°C. The amount of alcohol productions differed especially during the first week of fermentation. Among guava varieties, Punjab Pink was relatively slower than other wines with regard to ethanol production rate. The yield of wine production was increased using processing of guava juice with pectinase. Wine made from all varieties showed a decreasing trend for pH. Lowest value of pH was found for guava wine made from Allahabad Safeda at the end of fermentation period. Punjab Pink variety of guava fruit had the most desirable characteristics suitable for guava fruit wine production.

Keywords: Wine, Guava, TSS, Saccharomyces cerevisiae, Fermentation

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Introduction

Guava (*Psidium guajava L.*) belongs to the myrtaceae family is one of the most important commercial fruit crops in India consumed locally. It ranks 4th in area and production after mango, banana and citrus fruits. It is a very hardy sub-tropical, prolific bearer plant. India is one of the major producer as well as exporter of guava to the developing and the developed world. This hardy fruit is cultivated widely all over India. Allahabad (Uttar Pradesh) has the reputation of growing the best guava in the country as well as in the world. In India, it is commonly called as poor man‘s apple widely naturalized in the country and is often considered as a “super fruit” due to its rich nutritional value. These fruits have a high digestive value, and also contain Vitamin A (beta carotene) and Vitamin C (ascorbic acid) in considerable amounts. The seeds are rich in omega-3 and omega 6 fatty acids, dietary fibers and mineral salts. The antioxidant properties in guavas are due to the presence of high amounts of vitamin C (Ascorbic acid) and a carotenoid lycopene which helps in the prevention of many degenerative diseases [1, 2]. Pleasant aroma and taste of guava are highly appreciated across India and make it competent in the market, either as guava juice or as mixtures with other juices or as guava wine.

During the past few decades, grapes have been the main fruit that were used for wine production. Despite that, several studies have investigated the suitability of other fruits as substrates for the purpose of wine production [3, 4]. Moreover, the non-availability and high cost of grapes, which is usually the fruit of choice for wine production in the tropical regions has necessitated the search for alternative fruit sources in tropical countries [5].

High rate wastage of these fruits especially at their peak of production season necessitates the need for alternative preservation and post-harvest technologies towards their value addition that can reduce the level of post-harvest losses besides increasing diversity of wines. Therefore, the aim of the present study is preparation and quality evaluation of the guava wine comparison of the two strains for guava fruit wine production.

Materials and Methods

Chemicals

Folin-Ciocalteu reagent (diluted 1:2 with distilled water) and sodium carbonate reagent (35g of sodium carbonate dissolved in 60 ml distilled water and made final volume of 100ml), Potassium Dichromate Solution **(**0.23N $K_2Cr_2O_7$), 4% oxalic acid, 2.6- dichlorophenol indophenol, 0.1N NaOH, phenolphthalein solution as indicator.

Raw material

Three varieties of Guava fruits (Allahabad Safeda, Chittidar and Punjab Pink) with 80-90% maturity and free from visual blemishes and bruises were procured during their peak harvesting periods from local markets.

Culture

Yeast strain (*Saccharomyces Cerevisiae* 1035) was procured from Indian Type Culture Collection (ITCC), Division of Plant Pathology, Indian Agricultural Research Institute (IARI), PUSA, New Delhi. Guava sap obtained after washing the guava was inoculated on PDA media to obtain native strain of *Saccharomyces Cerevisiae* in laboratory, Department of Recombination Techniques, SVPUA&T, Meerut. The tubes containing these two strains were kept at 25 degree Celsius temperature for 48 hours and a full test tube along with PDA (Potato Dextrose Agar) media is poured into one liter juice of guava and incubated at 28±2°C for 24 hours under anaerobic conditions.

Guava juice preparation

Ripened guavas were washed with tap water, trimmed to remove blemishes (if any), cutin halves and deseeded. The guava halves were sliced into about 2 cm thickness and blended with appropriate amount of added water using blender for 3 min. The guava puree was filtered through a muslin cloth to obtain the juice.

Enzyme treatment (Pre-treatment)

200 g guava pulp was subjected to enzyme treatment with pectinase. The reaction was carried out in a water bath shaker (30 ± 2 °C) with a constant stirring rate of 100 rpm, and then heated at 90°C for 5 min in order to inactivate enzyme activity. The guava puree was filtered through a muslin cloth to obtain the juice. The use of enzyme in a mash treatment is now essential in juice industry and it shows increases in yield and ascorbic acid and also promotes juice clarification in a short processing [6, 7].

Amelioration of TSS

Total Soluble Solid content (TSS) of enzyme treated guava juice was ameliorated to 20°B by adding sugar solution.

Adjustment of pH

The pH of the guava juice was adjusted to 4.0 by addition of calcium carbonate and citric acid respectively

Determination of Total Soluble Solids (TSS)

TSS (total soluble solid) of mango juice was measured by hand refractometer of range of 0-32° Brix and for measuring TSS of wine. Use of this method was recommended by Srivastav and Kumar [8]. A brief description is given below.

A drop of sample was placed on the prism and the observation was taken in front of sunlight. The visible scale showed a dark line indication measuring TSS in degree Brix (°B).

Determination of pH

pH is the measurement of the logarithm of inverse of hydrogen ion concentration in the solution.

$$pH = -\log [H+]$$

Where, H+ = hydrogen ion concentration (g\ lit)

The electronic pH meter (Elico, LI -127) was calibrated using 7 pH and 4 pH standard buffer solutions. Then electrode was dipped in the test solution and the temperature knob was adjusted to temperature of test solution. The function selector switch was set to pH and reading of digital display was allowed to stabilize. pH values were determined with the help of electronic pH meter (Systronics µ pH system - 361) as recommended by Ranganna [9].

Determination of ethanol

Standard ethanol cure is obtained by using spectrophotometer. Sample and standard concentrations were prepared by distillation in potassium dichromate solutions. The ethanol was estimated by colorimetric method as described by Caputi [10].

Preparation of Reagent

Potassium Dichromate Solution: Thirty four grams of $K_2Cr_2O_7$ was dissolved in 500 ml distilled water and 325 ml of sulphuric acid was added and volume was made up to 1000 ml with distilled water to give 0.23N $K_2Cr_2O_7$.
Preparation of Stock Solution: Standard stock solution of 100 per cent pure analytical grade (containing 789 mg/ml) ethanol was prepared by dissolving 12.6 ml of ethanol in 100 ml distilled water, which results in 100 mg/ml of standard ethanol.

Procedure

One ml of representative samples from each treatment was transferred to 250 ml round bottom distillation flask connected to the condenser and was diluted with 30 ml distilled water. The sample was distilled at 74-75°C. The distillate was collected in 25 ml of 0.23 N $K_2Cr_2O_7$ reagent, which was kept at receiving end. The distillate containing alcohol was collected till total volume of 45 ml was obtained. Similarly standards (20-100 mg ethanol) were mixed with 25 ml of $K_2Cr_2O_7$ separately. The distillate of samples and standards were heated in water bath at 60˚C for 20 minutes and cooled. The volume was made up to 50 ml with distilled water and the optical density was measured at 600 nm using Systronics spectrophotometer –117. The standard curve was plotted considering the concentration against absorbance

Determination of acidity

Acidity of various samples was determined by using the method as recommended by Ranganna [9]. A brief description is given below:

5 ml sample was dissolved in a 100 ml of distilled water and out of this 10 ml aliquot was taken and titrated with 0.1N NaOH using a few drops of phenolphthalein solution as indicator. The endpoint was denoted by the appearance of pink color. The titre value was noted and result was calculated as % acids using following equation:

$$\% \text{ Acidity} = \frac{\textbf{Vol. of NaOH} \times \textbf{0.1N} \times \textbf{0.064} \times \textbf{100}}{\textbf{Volume of sample taken} \times \textbf{1000}}$$

Results and Discussion

Tables 1 and **2** show physicochemical properties of guava wine obtained from pretreated guava juice of three varieties viz. Allahabad Safeda (AS), Chittidar (CD) and Punjab Pink (PP). The guava juice was pretreated with pectinase enzyme, which caused an increase in ethanol yield, but decrease in pH and TSS values as shown in **Figures 1, 2** and **3**. It also improved clarity of the guava juice. It was observed from Table 1 that both TSS and pH follow a decreasing trend with increase in the fermentation period, while Acidity and Ethanol content were found to be increasing with storage (as per the Table 2 and Figure 4). These results reveal that TSS declines to nearly zero after 60 days in all the varieties of Guava for both *S. cerevisiae 1035* and native strains. The highest ethanol yield was obtained after 30 days with Native strain of Punjab Pink variety. Results present in Tables 1 and 2 revealed that the overall *S cerevisiae* strain 1035 performed better than native *S cerevisiae* strain and had higher fermentation efficiency over the native strain. All the four parameters i.e. pH, TSS, acidity and ethanol yield presented significantly different values when both strains were compared with all three varieties. A fermentation period of 30 days was found to be optimum for completion of fermentation with Brix decreasing to zero in both the strains with pectinase treated guava juice in all varieties of guava fruits. In terms of ethanol production, *S. cerevisiae 1035 strain* produced significantly higher ethanol in terms of strain variation with Punjab Pink variety.

Table 1 Comparison of pectinase treated and untreated Guava juice for ethanol production by *S. cerevisiae* strain 1035 and Native strain

Fermentation time (days)	Parameters											
	Brix (°B)						pH					
	S. cerevisiae strain 1035			Native strain			*S. cerevisiae* strain 1035			Native strain		
	AS	CD	PP	AS	CD	PP	AS	CD	PP	AS	CD	PP
0	20.00	20.00	20.00	20.00	20.00	20.00	4.00	4.00	4.00	4.00	4.00	4.00
15	13.83	13.33	13.67	14.00	13.50	13.83	3.82	3.84	3.92	3.85	3.84	3.92
30	8.67	8.83	8.33	8.83	8.67	8.50	3.73	3.71	3.83	3.71	3.72	3.81
45	0.67	0.83	0.83	0.67	0.87	0.83	3.56	3.58	3.65	3.57	3.58	3.67
60	0.00	0.00	0.00	0.00	0.00	0.00	3.33	3.35	3.47	3.33	3.35	3.46

Table 2 Comparison of pectinase treated and untreated Guava juice for ethanol production by S. cerevisiae strain 1035 and Native strain

Fermentation time (days)	Parameters											
	% Ethanol						Acidity					
	S. cerevisiae strain 1035			Native strain			*S. cerevisiae* strain 1035			Native strain		
	AS	CD	PP	AS	CD	PP	AS	CD	PP	AS	CD	PP
0	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.29	0.38	0.32	0.29	0.38
15	11.81	11.88	11.80	11.79	11.68	11.58	0.59	0.49	0.68	0.57	0.48	0.68
30	16.01	14.65	15.67	16.05	14.46	16.08	0.82	0.68	0.87	0.78	0.67	0.86
45	11.64	11.81	11.12	11.14	11.82	11.17	1.12	0.99	1.61	1.08	0.98	1.57
60	8.41	7.46	7.76	8.68	7.58	7.69	1.52	1.27	1.90	1.48	1.30	1.86

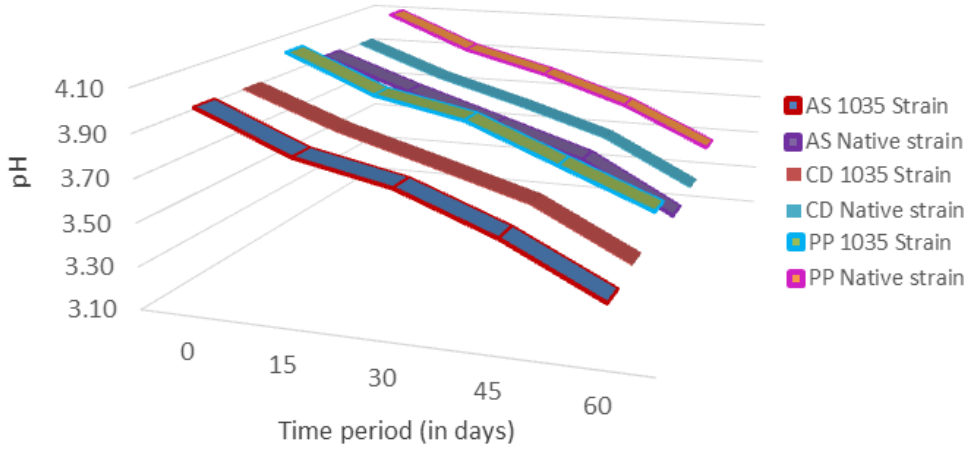

Figure 1 Variation in pH of guava wine produced from three varieties of Guava using *S. cerevisiae* 1035 and Native strains

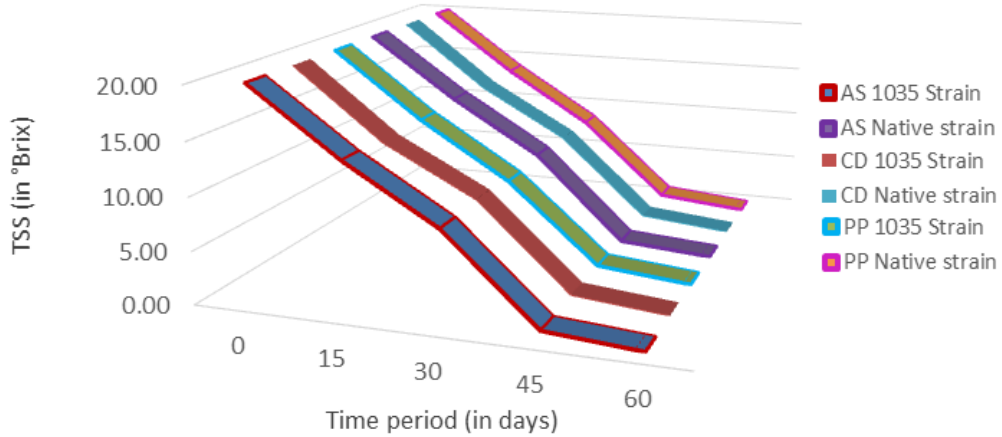

Figure 2 Variation in TSS of guava wine produced from three varieties of Guava using *S. cerevisiae* 1035 and Native strains

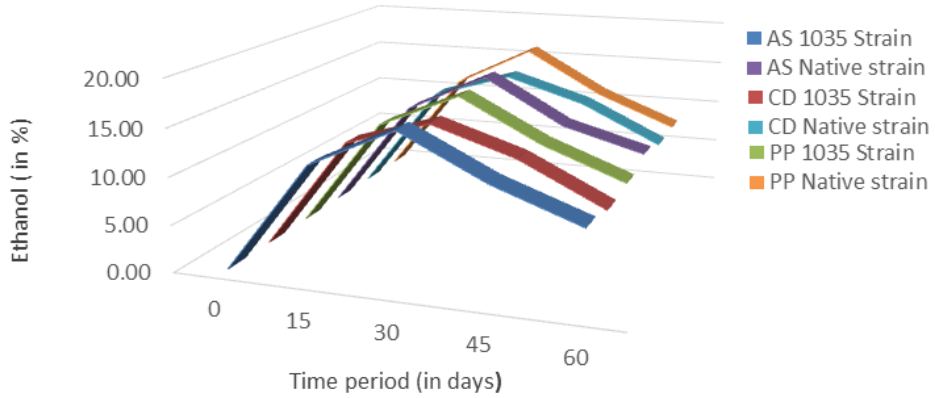

Figure 3 Variation in Ethanol content of guava wine produced from three varieties of Guava using *S. cerevisiae* 1035 and Native strains

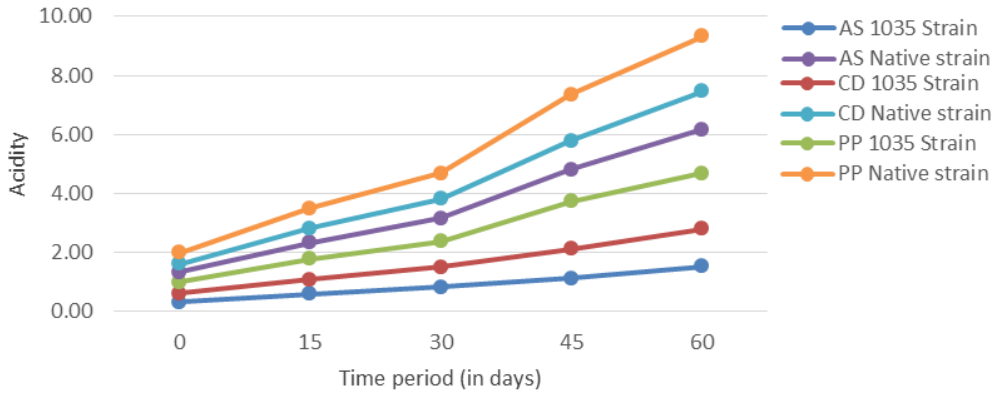

Figure 4 Variation in acidity content of guava wine produced from three varieties of Guava using *S. cerevisiae* 1035 and Native strains

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