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ORIGINAL ARTICLE

Preparation and Evaluation of Wine from Sugarcane and Beet Juice

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ABSTRACT
Sugarcane (Saccharum officinarum L.) juice which contains high amount of sugar was used as raw material and an attempt was made for the standardization of the process of preparing wine from sugarcane- beet (Beta vulgaris Linn.) juice blending. Among the sugarcane blended with beet juice non-pasteurised blended at 50%, total soluble solids (TSS) 24.4 ^{0}Brix, 26 ℃ and pH 4.5 during fermentation was observed to be the best and it produces wine of alcohol (9.4%), TSS (7.7^{0}Brix), 0.3%titrable acidity (TA) and 1.19%total reducing sugar (TRS) with good flavour, colour and overall acceptability. After 6 months of storage the alcohol(9.6%) and titrable acidity (0.72%) was increased while the other parameters decreased. Therefore, storage improves the quality of wine. Thus, this could be one of the post harvest management method for value addition while reducing the post harvest loss.
Key words: *blend, fermentation, sugar, sensory evaluation, beet,wine*

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INTRODUCTION

Over the years, sugarcane has been used as a source of sucrose however, due to the introduction of high fructose corn syrup, a cheaper sweetener, a dramatic reduction in the use of sucrose by the food industry has occur [13]. The other important sugar crop, sugar beets (Amaranthaceae)was also used to produced sugar along with sugarcane in factories and extend their processing period such as in Egypt. Beetroot contains no fat, low calories, good source of fibre, high folate, iron, potassium, polyphenols, flavonoids (lycopene, leutin etc.) and vitamin C known for their antioxidant properties hence good for women and pregnancy [4].However, India being the second largest producer of sugarcane after Brazil [7, 9] the use of sugarcane in other processing needs to be encouraged other than using in food industries. Therefore, it calls for the need of the alternative use of these crops. The high sugar content of sugarcane and high antioxidants (flavonoids and Vitamine C), attractive colour and high sugar of beet root make it an ideal source for the production of wine from their blended juice.

MATERIALS AND METHODS

Preparation of samples: Fresh sugarcane juice was collected from the local market while the beetroot juice extract was prepared by adopting following steps: washing, cutting into pieces and then boiling (low heat) the pieces with little amount of water (300g/100ml) for 20-25minutes. It was then filtered through a strainer to get a clear juice. The TSS of sugarcane juice was made to 45 ^{0}Brix by adding sugar. It is then blend with the beet extract at different concentration 40%, 50%, 60% and 70%. Blended juice of each concentration was divided into two equal parts of which one was pasteurized at 70^{0}C for 20 minutes and the other unpasteurized for all the blending concentrations. Before pasteurization all blended substrates were adjusted to pH 4.5 by adding citric acid.

Preparation of wine: The blended juice samples were inoculated with starter inoculum (Y_4), an unknown yeast *Saccharomyces cerevisiae* strain isolated from palm juice at 1.2 x 10^8 cells per ml @ 10% of the samples and kept in the incubation chamber at temperature (26±2) °C for fermentation.

Analysis: After fermentation i.e. when two consecutive days showed same ^{0}Brix of the fermenting substrate and after 6 months of storage prepared wines were subjected to analyse for TSS, pH, acidity, reducing sugar and % alcohol. TSS was measured by pocket refractometer, pH by pH meter [2], acidity as percentage citric acid by A.O.A.C. method [1], reducing sugar by Fehling's method [10] and alcohol content by high-pressure liquid chromatography (HPLC). The HPLC was equipped with a quaternary pump, a manual injection valve and C-18 Column.The wine sample to be analysed was first distilled. Maintaining the temperature of the column at 25 °C, mobile phase, H_2O (HPLC grade), sample was injected at the flow rate of 1ml/min followed by the 20 µl of distilled wine samples and the peaks were recorded with the corresponding retention time, for ethanol analysis [12, 14].

Sensory evaluation: Sensory evaluation for colour, flavour and overall acceptability (OA) were carried out by 5 point hedonic scale [6, 15] ranging from "dislike very much" to "like very much". Out of 5 point hedonic scale, the score 3 and above were being selected as acceptable whereas below this level the products were considered unacceptable by the panelists.

Statistical analysis: CRD (Completely Randomized Design), Single Factor ANNOVA following standard analysis method by IBM SPSS STATISTICS 19 software, was carried out of the observed data.

RESULT AND DISCUSSION

Physico-chemical characteristics

It was evident from the result (Table 1) that as the sugarcane juice blending increases from 40% to 70%, the TSS and alcohol content also increased (Figure 1) while TRS and acid content did not. TRS estimation was done as the first step in sucrose utilization by ethanolic yeasts in its complete hydrolysis into glucose and fructose by an extracellular invertase [11, 3]. In sugarcane samples complete glucose consumption on one hand and on the other fructose in the sugarcane particles produced during fermentation by sucrose hydrolysis accumulated in the medium possibly due to the impairment of fructose transport system, hence more fructose were analytically detected at the end of fermentation was reported by Carlos and Roberto [5]. A similar result was published by Wu *et al.* [16]for ethanolic fermentation of sweet sorghum juice.

Thus, maximum alcohol production (11.7%-11.6%) was observed at sugarcane juice concentration of 70%. Pasteurized juice produced less alcohol per cent than non-pasteurized juice in all blending which might be due to the presence of wild microorganisms in the fermenting substrate which enhances the utilization of sugar and increasing in ethanol production. The total acidity ranges from 0.21-0.79%. Overall, pasteurized samples are higher in TSS, acidity and reducing sugar but less in alcohol % as compared to the non pasteurized samples expectedly, where there were high alcohol content in wines, TSS contents were low.At the end part of fermentation, least change was detected in sugar concentration but after 6 months of storage it showed a slight decrease in TSS, reducing sugar but increase in the alcohol % and acidity. These variations in values might be due to further utilisation of the remaining sugar by the fermenting yeast left and converting the sugar to ethanol and CO_2. As 70% of the total amount of alcohol was produced during primary fermentation which last up to (3-7) days and the remaining 30% was produced by secondary fermentation that last up to two weeks [8] The TRS (total reducing sugar) content was significantly ($P<0.001$) related to the TSS and alcohol content of wine after preparation and after 6 months storage.The effect of pasteurization and non pasteurization on the sensory quality of cane: beet blended wine was given in Figure 2. The colour development was based on the percent sugarcane juice and blending material. Expectedly, lesser the amount of sugarcane juice concentration used higher the beetroot extract content and denser in colour, so better was the colour score. Among the samples non-pasteurized 50% cane: beet blending scored the highest sensory quality. Overall, non pasteurized samples showed better acceptability as compared to the pasteurized samples.

Table 1: Changes in quality parameters of cane: beet blended wine following pasteurization (1) and non-pasteurization (2) by yeast isolate Y_4.

SUGARCANE JUICE (%)		TSS(I) at pH(I) 4.5	WINE AFTER FERMENTATION					AFTER 6 MONTH STORAGE			
			pH (F)	TSS (F)	Alcohol %	TA %	TRS %	TSS (S)	Alcohol (S) %	TA(S) %	TRS(S) %
40	1	21.3	3.7	6.7	8.2	0.26	1.43	6.3	8.4	0.47	1.39
	2	21	3.6	6.9	7.9	0.3	1.67	6.4	8.2	0.56	1.36
50	1	24.6	3.8	7.6	9.5	0.21	1.15	7.2	9.7	0.56	1.05
	2	24.4	3.65	7.7	9.4	0.3	1.19	7.3	9.6	0.72	1.11
60	1	29	3.6	9.1	11.1	0.26	1.71	8.7	11.4	0.49	1.46
	2	28.7	3.5	9.3	10.9	0.38	2.96	8.9	11.1	0.68	1.77
70	1	31.1	3.5	10.2	11.7	0.38	3.16	9.7	12	0.6	1.67
	2	31.5	3.45	10.8	11.6	0.42	6.01	10.3	11.9	0.79	2.31
SEm(±)		0.523	0.074	0.148	0.258	0.019	0.046	0.117	0.265	0.015	0.043
CD		1.57	NS	0.45	0.77	0.06	0.14	0.35	0.79	0.45	0.13

Note: I, Initial; F, after fermentation; S, after storage

Figure 1: Change in alcohol percentage (%ol) after fermentation for different blending concentration of cane: beet with respect to initial total soluble solids, TSS(I).

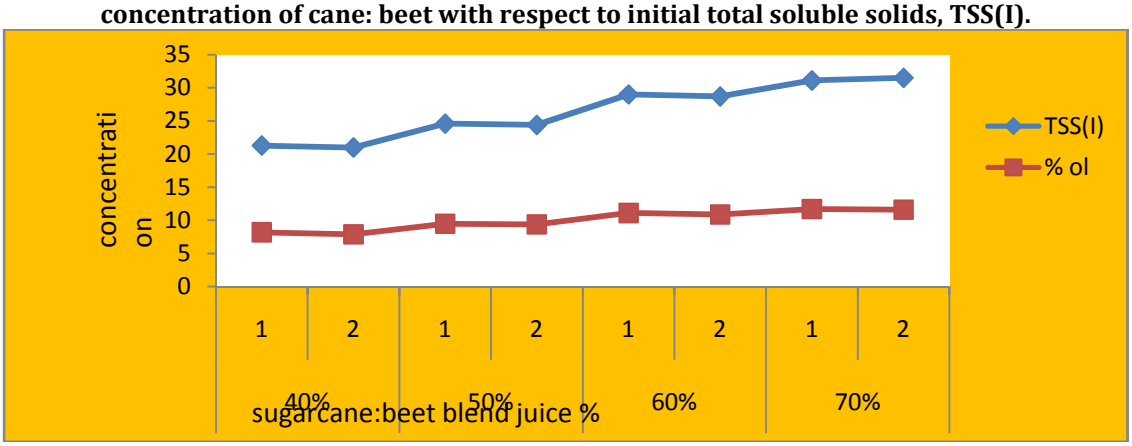
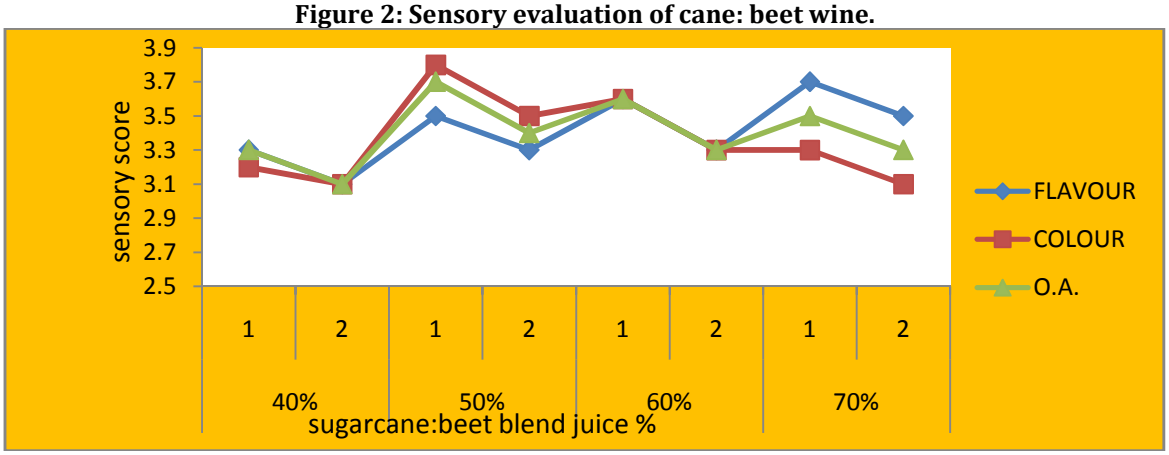


Figure 2: Sensory evaluation of cane: beet wine.



CONCLUSION

It is concluded that wine of good colour, flavor and overall acceptability can be prepared from sugarcane beet juice non-pasteurised blended at 50%, TSS 24.4 ^{0}Brix, 26 °C and pH 4.5 during fermentation followed by storage. This could be one of the alternative post harvest management which provides the room for

further research on the characterization of antioxidant and flavouring compound(s) and value addition of wine by blending.

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