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Fermented Products from Sugarcane Juice - Beyond Ethanol and Sugar

Sugarcane juice is predominantly used for the industrial production of sugar and ethanol. Some other commercially significant products obtained from sugarcane involves molasses, bagasse, khandsari (brown sugar) and gur (jaggery). Often sugarcane juice is blended with citrus lime, pine apple juice, ginger extract, gooseberry juice, mint leaves extract and served fresh as a refreshing drink in street markets and also in supermarkets as a bottled beverage. The art of preservation of sugarcane juice by fermentation yields value added products such as sugarcane toddy wine, vinegar and distilled products like rum and beverages similar to rum are *Cachaca*, *Aguardiente* and *Guaro*. Traditionally fermented sugarcane juice products are *Sidhu* in India, *Basi* in Phillipines, Australian sugarcane ginger beer. The industrial by-products obtained after ethanol production are vinasse and dunder.

INTRODUCTION

Sugarcane is one of the most viable commercial crop that finds its application for fuel ethanol and sugar production all over the world in over 110 countries. Sugarcane juice is widely available in India as fresh juice from street vendors. The biggest problem for the preservation of juice is that it ferments very easily. Within 15-20 minutes of crushing, the colour and flavour of the sugarcane juice changes visibly due to high phenol oxidase activity. Sugarcane juice acts as a wonderful carbon substrate for the production of any fermented beverages. Sugarcane juice fermentation proves to be a viable alternative technology for the production of fruit wines, since the juice contains all the essential characteristics of an alcoholic

beverage. The carbon source found in sugarcane is mainly sucrose which undergoes invertase activity by yeasts. The juice contains 9 - 18 % of sucrose depending upon the varieties of sugarcane with the total soluble solids ranging from 16-24° Brix. Apart from sucrose, sugarcane juice also contains amino acids, vitamins and minerals such as iron, calcium, phosphorus, manganese and zinc. The use of non-*Saccharomyces* yeasts along with *S. cerevisiae* imparts aroma for the beverage due to the secretion of metabolic compounds and improves the quality of wine. Non-*Saccharomyces* yeasts are *Brettanomyces bruxellensis* and *Pichia caribbica*. They both play a key role in the production of *Kombucha* and sugarcane pineapple blends. Phenyl ethanol, methyl propanol, methyl butanol, ethyl acetate, phenyl ethyl acetate, diethyl succinate and α -terpineol are some of the identified volatile compounds in sugarcane juice and pineapple blends due to *P. caribbica* fermentation. Co-culturing of *B. bruxellensis* and *Acetobacter xylinum* in sugarcane juice blended with tea extracts yields a sweet and aromatic beverage called as *Kombucha*.

TRADITIONAL FERMENTED SUGARCANE JUICE PRODUCTS

Fermented sugarcane juice prepared without boiling process is called as *madhura dravya* or *apakwa rasa sidhu*. When the liquid is boiled after fermentation, it is called as *pakwa rasa sidhu*. Boiling increases sugar concentration from 12% to 25% approximately. In the ancient and early medieval India, the traditional type of beverage made from sugarcane is called as *Sidhu*, a Sanskrit word. Some other drinks prepared from cane juice are *asavas*, *aristas* and *maireya* exhibits medicinal importance. It is mentioned in the epics, in early medical texts, in the *Svetambara Jain Uttaradhyayanasutra*. *Sidhus* are primarily intoxicating fermented drinks made from sugarcane sources. Sugarcane juice or molasses are used for the preparation of traditional fermented beverages such as *basi* or regionally called as *betsa-betsa* in Phillipines. It contains 12-15% of alcohol with a sweet flavour. Two types of *basi* are prepared. One is called as sweet or *babae* (33° Brix) and the other is called as bitter or *lalake* (28° Brix). The product is developed by fermentation of sugarcane juice along with leaves of *Psidium guajava*, bark and fruits *Syzygium cumini*, bark and leaves *Macharanga tanarius*.

SUGARCANE VINEGAR

Sugarcane juice proves to be a highly suitable substrate due to its high sugar content. *Sirka* (Hindi word) is traditionally prepared cane vinegar during summer months in Northern India. Sugarcane vinegar is commonly used in Filipino cooking. The acetic acid content ranged from 8 to 14 mg/g. Hence, it is added to salads, main dishes and desserts. At room temperature, after nine days submerged alcoholic fermentation through yeast followed by acetic acid fermentation high quality sugarcane vinegar drink can be manufactured. The prepared vinegar is rich in benzoic acid, ferulic acid, quinic acid, chlorogenic acid, caffeic acid, p-coumaric acid, luteolin, apigenin and kaempferol.

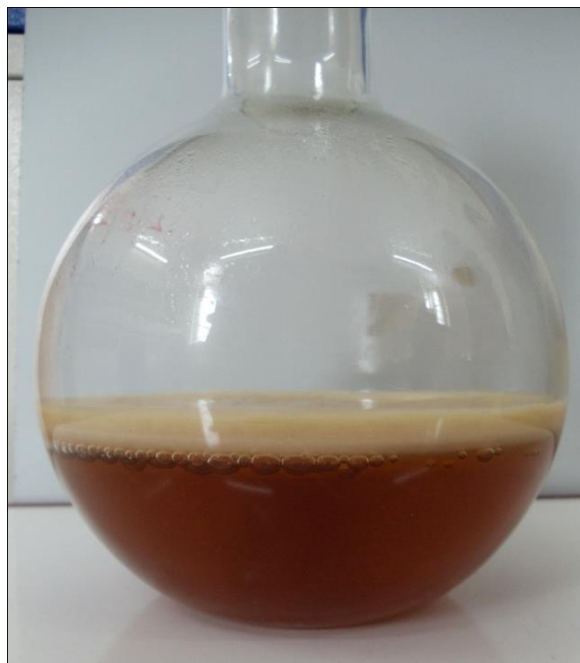


Figure 1. Formation of Kombucha mat by *Acetobacter xylinum* in fermented sugarcane juice

RUM

Rum is type of distilled alcoholic beverage made from the fermented juice of sugarcane, sugarcane syrup, sugarcane molasses or other sugarcane by-product and contains about 40% alcohol. Rum is aged or matured in charred white-oak barrels and possesses a distinct flavour, aroma, taste and colour. Blackstrap molasses with pH adjusted to 4.0-4.7 are fermented by *Saccharomyces cerevisiae* at 27°C for 3 to 7 days. The temperature of the final product rises to 35°C with an alcohol content of 35-54%V/V. *Cachaca*, *Aguardiente* and *Guaro* are some other distilled beverages similar

to rum obtained from sugarcane juice. *Cachaca* is distilled rum like product specially made in Brazil from fresh fermented cane juice that undergoes single distillation process. Rum is basically used in the preparation of ice cream, candies, tobacco curing and in pharmaceuticals. Two types of rum are there. They are the light and heavy rum. Light rum is mildly alcoholic and heavy rum is also called Jamaican rum or *grand arome*.

SUGARCANE TODDY WINE

Fresh sugarcane is crushed and the juice is filtered, transferred into earthen pots and stored for 24 hours without stirring. An old earthen vessel offers a fine taste for the wine than the new pots. The porous surface of the earthen pot harbours yeasts and brings about specific ethanolic fermentation. Not only that, natural cooling of the cane juice under fermentation by evaporation which allows the concentration of sugar to rise naturally. Wine stabilizers may be added, refrigerated and served chill. The final product contains 6-8% of alcohol with sweet-sour taste.

SUGARCANE GINGER BEER

It is a traditionally brewed ginger beer and a refreshing soda without alcohol. This is an Australian favourite cocktail mix. This drink is prepared by fermentation of sugarcane juice with special yeast, and brewed over three days from locally grown ginger and sugarcane originated from a place at Bundaberg, Queensland, Australia.

VINASSE

Sugarcane based ethanol industry produces a substance called as vinasse. During ethanol fermentation by yeast, ethanol is liberated which is recovered after distillation. The remaining waste left after the recovery of ethanol is called as vinasses. For each litre of ethanol produced, about 15 litres of vinasses are produced. They are rich in organic matter and three crop specific important nutrients such as nitrogen, phosphorous, and potassium which make it largely suitable for fertilizer production especially for sugarcane crop.

DUNDER

It is a secondary by-product produced from fermented molasses from ethanol production unit. It is a source of minerals and gums and rich in potassium and is an intensively used feed stock for beef cattle in Australia. It is used as a carrier material in the feed nutrients for cattle such as the coating in white cotton seed for improving storage stability.

CONCLUSION

Fermentation of sugarcane juice both by yeasts and acetic acid bacteria favours the production of value added fermented products of high utility with excellent antioxidant potential. Products like vinegar, sugarcane toddy wine can be used for food preservation and seasonings that has a good market value among organic food lovers and of more commercial significance.