

A Study on the Burnt Cane Juice Clarification by Different Clarificants



Science

KEYWORDS : burnt cane, deterioration, flocculant and clarification.

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ABSTRACT

It is generally accepted that after cane has been cut or burnt, it immediately starts deterioration. Burnt cane is known to deteriorate faster than unburnt (green) cane. Burning directly destroys some sugar and also promotes chemical changes that facilitate degradation of sucrose levels and purity. On the other hand the accumulation of impurities, dextran in particular, that results from burning, directly affects the processing and recovery of sugar, with these difficulties increasing as the proportion of burnt cane increases. The present work made an attempt to assess the difference clarification parameters of the burnt cane juice obtained by different sugarcane varieties and applying different flocculants. Experiments have shown decrease in weight, pol, purity and pH and also increase in brix, settling time and turbidity of burnt cut cane juice.

Introduction

It is generally accepted that after cane has been cut or burnt, it immediately starts deterioration. Burning of cane is a common practice in country norms. The trash of the plant are removed, cutting will be easier and the volume of harvested cane is reduced by burning the cane. Meyer¹ et al have resulted that pre-harvest burning increases efficiency of harvesting process. Eggleston^{2,3} et al have indicated that burnt cane is known to deteriorate faster than unburnt (green) cane. Furthermore, purity of subsequent raw sugar became progressively worse with increased trash levels, and every 1% increase in trash there was an approximate 0.13- 0.21% decrease in MJ purity. Foster⁴ has indicated that burning heats the interior of the cane stalk and its juices to 80– 98oC. This directly destroys some sugar and also promotes chemical changes that facilitate degradation of sucrose levels and purity of the juice. Davies⁵ has believed that if cane can be cut, transported and crushed within 16 hours of burning, milling costs and sugar recovery are not seriously compromised.

Sugarcane is harvested by manually in India and supplied to the factories free from tops, trash and other foreign matter, but a number of factories in some state crush the burnt cane around 20 to 60% and above, and in some other zone sugarcane is grown due to hot weather in months of March to May, the fire hazards to sugarcane crop usually occur. Occasionally, due to labour scarcity and weed grown with creeper cultivators burn the trash before harvesting, but harvesting and supply of cane to the factory is considerably delayed due to: labour scarcity, lack of adequate transport facilities and limited daily intake of cane by the factory because its low crushing capacity. Due to these difficulties the burnt and the unburnt cut cane is delivered to the factory with a lapse of 3 to 10 days after harvesting. Wood⁶ has reported that cane which is burnt and left standing shows a more rapid decline in recoverable sugar percentage than does cane which is burnt and cut immediately and delivers to milling. Davies⁷ has shown that in Fiji and in the 1996 harvesting season, 57% of burnt cane was delivered to the mill after 48 hours had elapsed and 22.6% after 96 hours.

On the other hand the accumulation of impurities, dextran in particular, that results from burning, directly affects the processing and recovery of sugar, with these difficulties increasing as the proportion of burnt cane increases. Thai⁸ et al have indicated that in comparison to juice expressed from burnt cane, the zeta potential values were more negative with juice particles originating from whole crop. Generally, removal of impurities from sugarcane juice by clarification, is an essential part of the process of sugar manufacture. Flocculation, coagulation and

precipitation of the impurities are three ways that can be done to clarification. Flocculation can be carried out by using chemical reagents, through heating or changing the pH⁹.

In order to improve the clarification system, flocculants are added prior to the settling stage but usage of flocculants in cane juice clarification depend upon the cane variety, maturity of cane, soil condition and process of clarification. The extensive use of polymers as flocculants is due to their distinctive characteristic attributes¹⁰. The polymers are convenient to use in minute quantities¹¹ (1-5 ppm) and flocs formed during flocculation are larger and better settling than the way the simple coagulating electrolytes settle. Hence, necessary to remove the maximum quantity of impurities from the expressed juice at the earlier stages to obtain pure crystallizable sugar. Bhaumik¹² et al have shown that considerable increase in the consumption of process chemicals on the burnt cane crushing over the normal cane. Hence there is increase in cost of production towards burnt cane crushing.

Finally, it is well known that deterioration and lag time between harvesting and milling on one part and also poor rate of settling disturbs clarification and this results not only in an inferior sugar quality but also with sugar more remains in solution to escape as molasses, elongated crystals, a poor colour and a high residual content of dextran. The present work made an attempt to assess the weight, brix, pol, purity, pH, settling time and turbidity of the burnt cane juice obtained by different sugarcane varieties which are abundantly grown in Mandya region by applying different commercially available flocculants such as Separan AP-30, Magnafloc LT-27 and synthesized flocculants polyacrylamide (P.A.M), and polyacrylic acid (P.A.A).

Materials and method

The sugarcane varieties collected from V.C Farm (Agriculture University Extension centre) of Mandya region in Karnataka state for the analysis in the month of March 2013. The period of present investigation was spread from 0 to 96 hours. All burnt bundle exposed to existing environmental conditions. Everyday juice was extracted from bundle on an electrically operated crusher and used for determining the various quality parameters. Before juice extraction, bundle weighed every day. So as to find out the loss in cane weight during the storage. The sugarcane juice was extracted, limed and heated to 70oC. The juice was then brought to boil– 100oC of juice was then poured into separate flask in which different quantities of settling aids were added. The mixture was thoroughly shaken and then poured into 500 CC graduated cylinders which were mounted on horizontal plat-form.

Preparation of stock solution

0.05% solutions were prepared by taking 0.5 g from each of different flocculants such as PAM, PAA, Separan AP-30 and Magnafloc-LT-27 were separated weighed and 80ml of water was added to each of them and kept for about 1 hour for complete soaking while being stirred intermittently. Then, there were slightly warmed and made up to 100ml with water respectively and pipette out 10ml into a 100ml separated volumetric flask and the made up to the mark with water.

Results and discussion

Table 1 has shown total increase in loss of weight, pol and purity percent and increase in brix percent within 96 hours. The increase in loss of weight of burnt cut till a period of 4 days after harvesting was calculated with reference to the initial weight recorded soon after harvest. There was a progressive increase in loss of weight. On the 4th day the losses was 11.3% due to evaporation of water through cut ends and surface. Brix means total dissolved solids by weight of solids matter in cane. These solids have direct relationship with pol% juice after start of ripening in cane plant till the cane starts deterioration and therefore, brix is considered a good parameter for the quality of cane. In this table and figure reveals that the brix% burnt cane juice was increased with the increased staling hours because storage time is a consequence of loss of water from cane stalk and this pseudo increase in juice brix doesn't have any beneficial effect on sugar recovery. Burnt cut cane recorded an increase of 8.7% in pol cane in 4 days time over the initial pol percent. The fall in purity burnt cut cane coefficient of juice was in accordance with the sucrose loss.

Table 1: weight, brix, pol and purity of burnt cut cane and its juice within four days

Parameters	Day			
	First	Second	Third	Fourth
Loss in weight (%)	2.6	5.4	10.1	11.3
Increase in brix (%)	1.9	5.9	6.5	7.2
Loss in pol (%)	3.4	3.7	5.2	8.7
Loss in purity (%)	5.4	9.8	12.0	16.5

(Average of five trials)

The increase of fall in purity of juice from 5.4% to 16.5% may be ascribed to initial loss of moisture and inversion of sucrose. Stale burnt cut cane juice has effect on purity of juice and consequently on sugar recovery that is the percentage of obtainable sugar in the cane juice. Table 2 has shown that the fall in pH and increase in acidity is in burnt cut cane. This suggests that the increase in acidity of juice is indicative of the deterioration process of the cane may be the problem is further complicated by the presence of dextrans and other products of microbiological contamination in burnt cut stored cane. uses of flocculants have shown same results. The increase in impurity of juice from 772(NTU) to 926.6(NTU), may be ascribed to initial loss of moisture and inversion of sucrose. Table 3 clearly explain of the effect of pre-harvest burnt cut staling of cane on purity of crusher juice. Use of flocculants results in fall in impurity juice, that P.A.A shows low turbidity (NTU) in compared to other flocculants, but after 48 hrs this results have shown that turbidity will be better for Magnafloc LT-27. It is observed from table 4 that settling time (min) was faster in the burnt cut fresh cane with treatment flocculants compared to burnt cut stale cane. The burnt cut cane that was crushed and treatment with Separan AP-30 in the fresh cane had settling time 37.42(min), but after 48 hrs Magnafloc LT-27 had better settling time 67.17(min) compared to other. Use of flocculating agents have shown decrease in settling time, except P.A.A.

Table 2: pH of burnt cut cane juice within four days by treatment flocculants

Materials	Day				
	Fresh	First	Second	Third	Fourth
Raw juice(RJ)	5.16	4.97	4.90	4.80	4.51
RJ+milk of lime(MOL)	10.35	10.00	9.90	8.95	8.66
RJ+MOL+P.A.M	10.04	10.02	9.66	8.69	8.42
RJ+MOL+P.A.A	10.15	9.88	9.59	8.83	8.51
RJ+MOL+Magnafloc LT-27	10.10	9.74	9.14	8.75	8.29
RJ+MOL+Separan AP-30	10.08	9.95	9.36	8.50	8.16

(Average of five trials)

Table 3: turbidity(NTU) of burnt cut cane treatment by flocculants within 4 days

Materials	Day				
	Fresh	First	Second	Third	Fourth
RJ	772.0	805.6	853.0	893.0	926.6
RJ+MOL	141.0	163.6	211.5	229.8	246.7
RJ+MOL+P.A.M	77.0	81.6	96.3	192.5	231.0
RJ+MOL+P.A.A	85.0	90.0	144.5	246.6	297.5
RJ+MOL+Magnafloc LT 27	89.0	90.8	93.5	102.3	115.7
RJ+MOL+Separan AP-30	78.0	82.3	97.5	156.0	195.0

(Average of five trials)

Table 4: settling time(min) of burnt cut cane within 4 days by treatment flocculants

Materials	Day				
	Fresh	First	Second	Third	Fourth
RJ+MOL	65.30	76.10	85.33	90.25	110.12
RJ+MOL+ P.A.M	70.00	78.51	89.15	100.33	140.26
RJ+MOL+P.A.A	45.16	55.45	62.15	87.00	95.45
RJ+MOL+Magnafloc LT 27	44.25	50.20	55.51	67.17	80.00
RJ+MOL+Separan AP-30	37.42	47.37	52.47	80.55	136.16

(Average of five trials)

Conclusion

On the basis of laboratory trials and the data presented in the paper, it is observed that there is very little deterioration in quality of the burnt cut cane if it is crushed immediately after harvested. However, there has been deterioration if the burnt cut cane harvested and supplied in the factory after two to three days. Laboratory trials have shown that treatment by flocculant has good result compared to without that about settling time (Min) and Turbidity (NTU). Also these trials have shown that increase storage time increased burnt cut cane juice brix %, reduced burnt cut cane weight and its juice pol and purity percent. These results revealed that increase storage time of burnt cut cane reduced pH and increased settling time and turbidity in burnt cut cane juice even with treatment by flocculants.

These results shown that by treated invent flocculants P.A.M and P.A.A, and commercial flocculant magnafloc L.T-27 and Separan AP-30. Flocculant P.A.A has good results for Turbidity in compared by other flocculants, but in settling time best results is

for Separan AP-30. Generally, time lag between harvest and mill results in reduced crushing rate, loss of recoverable sugar and

inferior quality of sugar. Due to this, in point view of economic manufacture of commercial sugar becomes more expensive.

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