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Changein Organic Acid Content of Cane Juice of Different Varieties During Maturity and Staling of Sugarcan

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ABSTRACT: Organic acids form a significant portion of the total non-sugars presentincane juice. The searealso produced in appreciable quantities during the sugar manufacturing operations. These acids and their salts of alkali and alkaline earth metals are soluble in water and have pronounced effects on the reactions of clarification and sugar losses in molasses.

The organic acids are regarded as potential source of melassigenic substances, some of these salts e.g. calcium oxalate and aconitate are responsible for scaling on heating surfaces of heat exchangers. The presence of organic acids and their salts also retorted the crystallization of sucrose. Organic acids are important impuritiesaffecting processing ofthe juice. The present study is aimed to ascertain any change in organic acid content at various levels of maturity and also when the harvested cane was allowed to stale.

Keywords: Organic acids, Sugarcane, Maturity, Staling, molasses

INTRODUCTION

Organic acids are originally present in cane juice and the acidity of the juice (pH5.2-5.4) is due to these acids. Thereare two types of organicacids(a) non-nitrogenous or carboxylicacids (b)nitrogenous acids. The carboxylic acids present in the sugarcane are aconitic, malic, oxalic and in traces succinic, glycolic, fumaricacids etc. aconitic acid is the most abundant and its quality is relatively higher in sugarcane. However trouble starts when the acids in the juice are in excess due to one or the other reasons, the acids like acetic and lactic are formed on account of deterioration of cane in post-harvest and post maturity periods due to inversion of sucrose or decomposition of reducing sugars at elevated temperature during processing. Microbial activity is another possible source of formation of carboxylic acids where molecular compounds such as sucrose and polysaccharides are decomposed to acids by micro organisms. Organic acids are important impurities which affects the processing of cane juice, so it is important to estimate the organic acid content in cane juice before processing.

LouIsian are search workers[1] emphasized the ineffectiveness of liming indeteriorated juice due to the presence of higher amount of organicacids and concluded that these acids are important impurities affecting further processing. Although these organic acids are present in small quantities but they are responsible for the acidity of juice.

Fort and Lauritzen[2] noted the increased acidity with the extent of damage of can eduring deterioration and regarded a drop of 4units in pH as an indicative of damaged cane. Owen[3] also made a similar observation.

Egan[4] in another study reported that quality of juice from deterioratedcane is lowered by a substantial drop of pH, probably due to the formation of organic acids. It may be mentioned that these non-nitrogenous organic acids of sugarcane play an important role in the process of clarification and sugar recovery.

Hermia G. R. et al. [5] reported that juice acidity beyond certain limit actasareliable test for deterioration. Shore M. [6]highlighted formation of lactic acid in relation sugar losses. It is now well known fact that organicacids are produced as aresult of decomposition of reducing sugars besides someportion of it is originally present incane. Wood et al.[7] pointed out the formation of highly complex compound in cane juice due to the presence of organic acid. Agarwal et al.[8]

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highlighted the formation of organic acids due to destruction of reducing sugar. Gupta *et al.*[9] are of the opinion that juice containing higher amount of organic acid requiremore lime during the clarification. Honig[10] has pointed out that self - decomposition of reducing sugars in presence of organic anions especially aconitateis one of the cause of colour formation. Rizk and his co-workers[11] ascribe the enzymic activity for increase in organic acid content of cane juice.

MATERIALS AND METHODS

The sugar cane varieties selected for the present study were CoS91269 and CoS94257 which are prominent sugarcane varieties not only in U. P. but also in entire northern India. Two commercially important cane varieties were grown in an experimental plot in the farm of the institute under identical conditions to have a uniform crop pattern. For this a well-leveled field of around one-hectare area was selected.

Since the cane crushing season in India starts from October and ends in May, therefore periodical cane samples were analyzed accordingly the cane samples were taken in the form of complete clump to avoid variation as far as possible.

The cane samples were harvested and divide into six almost identical lots. One of the lotwas crushed immediately while other was allowed to stale under normal conditions. There after one lot was crushed after every 24 hours up to 120 hours in a laboratory crusher.Then the juices were subjected to determination the organic acid content.Organic acid in the cane juice were determined by the method developed by Ramaiahet al[12]. This method is based on conductometric titration of organic acid content.

During the analysis 'A' class glassware of Borosil/ vensil make and chemicals and reagents of E-Merck/Ranbaxy quality were used. The principle equipments used was conductometer.

RESULT AND DISCUSSION

The analytical results of the total organic acids present in two cane varieties CoS 91269 and CoS 94257 in different months of crushing season as well as change in their quantity upon storage upto 120 hours are tabulated in Table 1 & 2.

The results presented in Table 1 reveal that in November the organic acid content in CoS 91269 variety at 00 hours was 295 mill.eq./lit which increased to 325 mill. eq./lit. after 120 hours the similar trend of increase in organic acid content was observed in months of December, January, February, March, April and May. In May the organic acid content at beginning was 273mill.eq./lit which increased to 335 mill. eq./lit after 120 hours thus accounting for around 23% overall increase. The monthwise studies of organic acid content also indicate that the organic acid contents was minimum in the month of March after which the organic acids increased continuously.

The results tabulated in Table no. 2 indicate that in variety CoS 94257 the organic acid content in November at 00 hours was 245 mill.eq./lit, which increased on staling and after 24 hours it increased to 250 mill. eq./lit, 255, 265, 273 and 283 mill.eq./lit after 48, 72, 96 and 120 hours respectively.

The similar trend of increase in organic acid content was observed in December, January, February, March, April and May, which were accounting for about 11%, 10%, 16%, 20%, 21% and 23% overall increase in organic acid content in these months. The month wise studies of organic acid content also indicate that in CoS94257 variety the minimum organic acid content was observed in February and then it continuously increased upto May.

Thus the results of both the varieties shows that organic acid content were found in higher concentration after storage of cane (upto 120 hours) which confirms the deterioration of sugarcane. The month wise study reveals that the organic acid content found in the month of November in both the varieties go on decreasing with the increase in the maturity of the crop and there after again shows an increasing trend. This indicates that organic acidcontentdecreaseon maturity of the crop irrespective of cane variety. These are again increased when the process of inversion of sucrose takes place resulting information of organic acids.

CONCLUSION

The organic acid content in juices accounts for the acidity in the cane juice. The study was aimed to observe change in the organic acid content at various levels of maturity and also when the harvested cane was allowed to stale.The experiments reveal that organic acid content of

the juice declined with the maturity status of the cane in both the cases. However, it shows an upward trend when the cane was allowed to stale. Interestingly such behavior was observed in both the cane varieties.

All the organic acids and their salts are very soluble in water and are not eliminated during clarification process. Being less stable these are capable of entering into complex reactions with sugar and are probable causes of the formation of unnatural melassigenic substances during the course of manufacture of sugar. As such, the loss of sugar increases due to higher molasses formation while processing the juice from stale and deteriorated cane. Therefore, it is of paramount importance to estimate quantitatively the organic acid content of cane juice so that the manufacturing chemist can understand and control the entry of salts of organic acid in cane juice and other process liquors to minimize loss of sugar in molasses.

Table 1
Change in Organic Acid Content (Milli.Eq./litre) of canevariety CoS91269

Duration	*Nov*	*Dec*	*Jan*	*Feb*	*Mar*	*Apr*	*May*
00 hrs	245	235	230	215	250	275	300
24 hrs	250	2240	233	220	257	283	310
48 hrs	255	245	237	225	269	290	320
72 hrs	265	250	242	230	274	300	335
96 hrs	273	255	247	240	285	315	350
120 hrs	283	262	255	250	300	335	370

Table 2
Change in Organic Acid Content (Milli.Eq./litre) of cane variety CoS94257

Duration	*Nov*	*Dec*	*Jan*	*Feb*	*Mar*	*Apr*	*May*
00 hrs	245	235	230	215	250	275	300
24 hrs	250	2240	233	220	257	283	310
48 hrs	255	245	237	225	269	290	320
72 hrs	265	250	242	230	274	300	335
96 hrs	273	255	247	240	285	315	350
120 hrs	**283**	**262**	**255**	**250**	**300**	**335**	**370**

References

[1] Waddel, C. W.,- "Stale cane losses" Proc. Q. S. S. C. T., 39-51, **(1952)**.

[2] Fort, C. A., Lauritzen, J. I.,- "Estimation of Degree of Souring in Sugar-cane Juice" Proc. I. S. S. C. T., 6th Congress, 809-818, **(1938)**.

[3] Owen, W. L., Soheuremann, G. G.,- "Inversion of sucrose and other physiological changes in harvested sugarcane"- I.S.J., 17, 275-280, **(1950)**.

[4] Egan, B. T.,- "Post harvest deterioration of sugarcane" Proc. Proc. Q. S. S. C. T., 39th Conf., 257-262, **(1952)**.

[5] Hermia G. R., Lourdes M. A., Escarilla T. and Gregorio J. V., - "Preliminary studyon the rate of deterioration of mechanically harvested cane"-Philippine Sug Tech Ass, 369-370, **(1982)**.

[6] Shore, M.,- "The formation of lactic acid in relation sugar losses"- Proceedings of 10th General Assembly C.I.T.S., London, pp. 196-202, **(1957)**.

[7] Wood R. A., Du Toit J. L. and Bruijn J.,- "Deterioration of wholestalk sugar cane"- S AfrSug Technol Ass., 151-157, **(1972)**.

[8] Agarwal, S. K., Johary, *et al.*,— "Formation of organic acids due to destruction of reducing sugars in cane juice" Proc. I. S. S. C. T., Part 3, 1388, (974).

[9] Gupta, A. P., Shukla, A. P., Juneja, I. S.,- "Parameter to evaluatest aleness of harvested cane, reducing sugar"- Sugar Tech Ass. of India. -78-84, **(1984)**.

[10] Honig. P.,- "Principals of Sugar Technology" Vol. 1, Elsvier Sci., Pub. Co. Amsterdam London, New York, 190-192, **(1963)**.

[11] Rizk T Y, Normand C.W. ,- "Enzyme activity and sucrose inversion"–Sugar J, 12-13, **(1968)**.

[12] Meade GP, Chen JGP Cane Sugar Handbook, 10th edn. A wiley Inter Science Publication, John Wiley and Sons, New York **(1977)**.