EFFICACY OF AN ORGANO-SULFUR BIOCID IN MINIMISING SUCROSE LOSSES IN MILLING TANDEM

By

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Abstract

Sustained application of organo-sulfur biocide (Kilbact™) was very effective in reducing losses in recoverable sugar by minimising inversion, organic acid and dextran formation during milling. Reduction in sucrose losses results in sugar saving of 1.5 to 2.5 kg/t cane, leading to improved sugar recovery, indicating that use of this biocide is cost beneficial under Indian conditions.

Introduction

The processing of sugarcane brings in a high population of viable micro-organisms and most of them are washed off into the extracted juice. These micro-organisms affect upstream processes by direct destruction of recoverable sugar into organic acids, alcohol and polysaccharides, leading to low sugar recovery. Chen and Chou (1993) reported that, during a one-hour delay of processing, sugar loss is around 7.7 kg/t cane. Studies conducted in India revealed that around 5–10 kg sucrose/t cane is lost due to these biological agents (bacteria and invertases) in harvested cane and milled juice (Solomon, 2000). To minimise sugar losses in the milling tandem and during subsequent processing operations, many chemicals are being used as sugar mill sanitation biocides. However, there is a renewed interest in using dithiocarbamate-based formulations, a class of organo-sulfur compounds, to minimise biological losses in tandem. This paper aims at evaluating the sugar saving efficacy of an organo-sulfur biocide (Kilbact™) and economic gains accrued to sugar processing units through its sustained application in the milling tandem.

Materials and methods

This organo-sulfur formulation (40% a.i.) was supplied by Multitrade Corporation, Bombay, and a large-scale mill test was conducted at Mysore Sugar Company, Mandya (India). The biocide was applied at 10 ppm on cane, at the last mill juice. The quality parameters, viz. pol % juice, reducing sugar, titrable acidity, pH and dextran formation were recorded with and without the addition of the recommended dosage of organo-sulfur biocide (OSB) from composite samples of primary juice, mixed juice, clear juice, unsulfited syrup and molasses.

Results and discussion

The following observations were recorded during mill trials:

i) Addition of OSB leads to about 58.8% reduction in reducing sugars from primary to mixed juice stage, which is indicative of its inhibitory effect on the inversion process.

ii) The titrable acidity value in process juice was significantly reduced, indicating a drastic reduction in the population of acid forming bacteria by addition of OSB. These micro-organisms play a significant role in consuming sucrose and converting it to organic acids.

iii) The formation of the undesirable bacterial polysaccharide dextran is appreciably reduced in the presence of OSB, which is responsible for direct loss of sucrose and numerous processing difficulties.

The analysis of data collected during the trial with OSB on reducing sugars and titrable acidity of primary-mixed juice at 10 ppm revealed the following:

a) A significant reduction in the rise of reducing sugars1100 Bx from primary to mixed juice was recorded during the period when OSB was added in the process juice. This clearly indicates that OSB has an inhibitory effect on invertase enzyme of plant as well as microbial origin. This is an additional property of organo-sulfur biocide which favours minimal inversion of sucrose.

b) The reduction in the rise of titrable acidity from primary to mixed juice during the period when OSB was added in the process juice was quite significant (80.82%). This indicates that the population of acid producing bacteria was drastically suppressed in the presence of OSB, favouring lesser diversion of recoverable sugar into organic acid production.

c) The results were reproducible and consistent with substantial economic gains as more sugar is diverted in the process with minimal invert, acid and dextran formation. The OSB is quite effective on bacteria and bacterial enzymes, as well as enzymes of the cane plant which are extracted in the milled juice.

d) From the results obtained during the mill trial, it was concluded that sugar saving (up to milling stage) is around 1.2 kg/t cane.

e) High amount of dextran was noticed in the process juice (primary/mixed) which indicated that a large quantity of sucrose is converted into dextran. Studies carried out with
OSB revealed that a low or negligible amount of dextran was produced in the presence of this biocide in primary/mixed juice, indicating near complete inhibition of Leuconostoc sp. If these losses are taken into account, higher sugar saving and better recovery is expected.

Big mill trials with organo-sulfur biocide carried out in eight sugar factories in India showed sugar saving in the range of 1.0 to 3.0 kg sucrose/t cane, which is a significant gain under Indian conditions. A similar trial done at McBride Sugar Company with Midland Laboratory PCS 6001 (organo-sulfur biocide) resulted in 0.82% increase in sugar recovery, equivalent to a saving of about US$111 000 per annum (Onna and Hashimoto, 1989). Reports published by Solomon (2000) indicated that application of ergano-sulfur biocide in the milling tandem results in sugar saving of 1.5–2.5 kg/t cane crushed.

**Conclusion**

Addition of organo-sulfur biocide (Kilbact™) was very effective in reducing losses in recoverable sugar by minimising inversion, organic acid and dextran formation during milling. Reduction in sucrose losses results in sugar saving of 1.5 to 2.5 kg/t cane, leading to improved sugar recovery. This amount of sugar saving, along with minimal formation of non-sugar compounds, showed that use of OSB is cost beneficial, under Indian conditions.

<table>
<thead>
<tr>
<th>Stages of sugar losses</th>
<th>Sugar losses during control (kg/t cane)</th>
<th>Sugar losses with OSB® @ 10 ppm (kg/t cane)</th>
<th>Sugar saved (kg/t cane)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing sugars</td>
<td>1.02</td>
<td>0.41</td>
<td>0.61</td>
</tr>
<tr>
<td>Titrable acidity</td>
<td>0.65</td>
<td>0.12</td>
<td>0.53</td>
</tr>
<tr>
<td>Total sugar loss/saved</td>
<td>1.67</td>
<td>0.53</td>
<td>1.14</td>
</tr>
</tbody>
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**REFERENCES**

