AN INVESTIGATION INTO UNDETERMINED LOSS AT KOMATI MILL

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Abstract

The boiling house recovery (BHR) for the 1994 and 1995 seasons were 81,6 and 81,9 respectively, while the undetermined losses were 3,9 and 3,7. Although the BHR values relative to the mixed juice purities for the above seasons appear acceptable, this paper focuses on possible ways of reducing the undetermined loss with a view to improving the BHR. Various processes have been investigated. Several modifications are recommended to reduce losses.

Keywords: juice purity, BHR, undetermined loss, Komati

Introduction

Since its commissioning in March 1994, Komati Mill (KM) has been in production for the 1994 and 1995 seasons. After a very successful project and commissioning phase, the production phase has run smoothly despite an average mixed juice purity of 78,5. The severe drought experienced over the past four years affected operating results, and impacted even more seriously on BHR and undetermined losses (Lionnet, 1984). The poor BHR and high losses at KM have prompted an investigation into the above performance parameters.

Method

The following areas were investigated:

- Scales and weighbridges by the usual comparisons.
- Purity drops across the clarifier and filter station.
- Tube failures in Kestner evaporators.
- Polybaffle entrainment arrestor cleaning.
- Maillard reactions.
- Sugar drier installation.

Results and discussion

Scales and weighbridges

Mixed juice and final molasses scales were checked as per the laboratory manual (Anon, 1985) and were found to be in order. The KM weighbridge compared favourably with that of Malelane mill and hence there was no cause for action in this respect.

Purity survey, clarifier and filter station

This area must undoubtedly be the largest section for losses at KM, as indicated by the purity drop between mixed juice and filtrate averaging in excess of five units. Insufficient head between the clarifier and mud mixer forced the operating staff to gravitate the mud to the mud liquidating tank, from where it was pumped to the mud mixer. Although this operation had inherent problems, it overcame the problem of insufficient head for normal gravity flow of mud to the mud mixer.

The problems were:

- Drop in mud temperature.
- Delay in filtration process.
- Semi-continuous mud removal.

Arising from the above, samples of mixed juice, limed juice, clear juice, mud and filtrate were sent to the Sugar Milling Research Institute (SMRI) in November 1995.

The results of this survey (shown in Table 1) confirmed the following:

- In all cases there is no substantial increase in lactic acid from mixed juice to clear juice.
- The marked increase in lactic acid levels in mud and filtrate indicate severe microbiological activity in these areas. Usually 1 000 ppm on brix of lactic acid in filtrate streams are considered acceptable (Madaree *et al.*, 1991).

Table 1

Results of survey

Sample	Lactic acid (ppm on brix)				
	14/11/95	15/11/95	16/11/95	17/11/95	18/11/95
Mixed juice	382	400	370	–	496
Limed juice	349	756	424	481	826
Clear juice	504	391	456	422	563
Filtrate	42 486	23 052	7 385	30 030	34 556
Mud	1 415	849	775	1 350	1 569

McMaster and Ravnö (1975) have quoted approximately two parts by weight of sucrose destroyed for every one part of lactic acid formed. However, other studies have shown that this ratio could vary from 4:1 to 1,4:1. For the purpose of this report the average ratio of 2:1 has been used. Taking an average of 27 500 ppm lactic acid in filtrate, this converts to approximately 0,38% sucrose loss. Although this loss appears high (Lionnet, 1981) a study of Appendix 1 shows that five points of filtrate purity drop is equivalent to a one unit drop in boiling house recovery (BHR).

As a result of these findings the following changes have been made:

- Reduction of the mud booth size from approximately 14 to 5 m^3. This is to be tested in the 1996-97 season.
- The filtrate return line has been shortened and re-routed directly to the mixed juice heaters instead of being returned to the mixed juice tank.
- Filtercake wash water temperature will be maintained at 85°C.
- The continuous dosage of bactericide will also be implemented at the mud mixer compared with batch dosage.
- A lifting screw is to be installed to lift the mud to the mud mixer and create a bigger pressure differential to compensate for insufficient head and pipe friction.

Tube failure in Kestner evaporators

Tube failures in Kestner 1 and Kestner 2 were also a source of undetermined loss (Olwage, 1996). This problem obscured the even greater loss due to entrainment in the polybaffle entrainment arrestors of separators 1 and 2. Reasons for tube failure are being extensively investigated.

Polybaffle entrainment arrestor cleaning

Inadequate polybaffle cleaning was the cause of excessive fouling of the baffles and resulted in serious entrainment. Sugar traces in V1 condensate ranged between 50 and 100 ppm. The entire set of polybaffles from separators 1 and 2 were removed during the off-crop and boiled in caustic for approximately eight hours. This effort proved very successful with spotlessly clean baffles being obtained.

The following changes have been made during the off-crop:

- Installation of blockage free sprays.
- The number of sprays per separator has been increased from four to eight.
- Closer positioning of the sprays for more effective washing.

Maillard reactions

Maillard type reactions in final massecuite in the continuous C-pan, the C-seed receiver and the C-crystallisers were also the cause of physical losses in the form of massecuite overflows, frothing and carry-over of massecuite on starting up the continuous C-pan, especially after long stops. The extent of this loss has not been clearly quantified. The following remedial action has been taken:

- Boiling at lower temperatures.
- Cooling of massecuite on stop days.
- Controlling C-massecuite purity between 50 and 52.
- Use of sodium hydrosulphite, which improved curing capacity.

Sugar drier

Leaks at the seal at the inlet of the drier have been the source of a small but continuous loss. Adjustment to the seal afforded only a temporary solution. The following have been implemented in March 1996:

- Extending and centralising the inlet screw to the sugar drier.
- Repositioning of the hot and cold air ducts to the drier.
- Improving air inlet flow to the drier.

Sugar cyclone installation

The level of dust being emitted from the duct of the rotoclone of the sugar drier was not acceptable for both the 1994 and 1995 seasons. At the end of the 1995 season the off-line sulphamic acid tank was modified and installed as a sugar cyclone in series with the rotoclone. This is still in the experimental stage although the adaptation proved successful and the level of dust emission has been greatly reduced. The saving from the installation is expected to be 0,15% sucrose.

Conclusions

Combining the measurable losses show that about 0,53% (0,38% + 0,15%) sucrose could be recovered. This converts to approximately one million Rand for a one million ton crushing season. Reduction of mud booth size, controlling of mud and wash water temperature, continuous mud removal and re-routing of filtrate lines is expected to bring down the purity drop between mixed juice and filtrate to more acceptable levels. Although difficult to measure, it is considered that the low cane purity must have affected performance adversely and, with the welcome rains, it is hoped that purities will rise and performance will improve.

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Annexure 1

Effect of filtrate purity on boiling house recovery

1. Base conditions:

Tons mixed juice per hour:	200
Brix % mixed juice:	13,00
Pol % mixed juice:	11,05
Filtrate % mixed juice:	20
Final molasses purity:	34,5
Drop in filtrate purity:	1 unit

The above change in filtrate purity accounts for 0,028 tons of pol lost; but there will be more non-pol which will cause increased losses of pol in final molasses.

$$\text{Increased pol loss} = \frac{(0{,}612 - 0{,}548)}{(100 - 34{,}5)} \times 34{,}5 = 0{,}015$$

$$\text{This represents } \frac{0{,}015}{22{,}1} \times 100 = 0{,}07 \text{ of Boiling House Recovery}$$

$$\text{Therefore total loss} = 0{,}13 + 0{,}07 = 0{,}2 \text{ unit of boiling house recovery}$$

Thus a 1 point drop in filtrate purity is equivalent to 0,2 unit drop in Boiling House Recovery. The above results are based on the assumption that the drop in purity of filtrate is due to sucrose destruction and not to increased extraction of brix.