TESTING OF WASH WATER EQUIPMENT IN A-CENTRIFUGALS AT FELIXTON MILL

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Abstract

The performance of the A-centrifugal station is of key interest in the final stages of raw sugar production, as it is one of the final unit operations that impacts on raw sugar quality. Good quality massecuite can easily be converted into poor quality sugar by bad curing conditions, and this paper discusses wash water equipment inside batch centrifugals.

A survey of the A-centrifugal station at Felixton (FX) raw sugar factory was conducted to establish what equipment exists, with a view to optimising raw sugar quality. This information was used to optimise operations on the A-centrifugals, especially with regards to wash water spray bars and nozzles. A brief trial was conducted at FX with a new multi-nozzle spray bar, and the results are discussed.

Keywords: centrifugals, A-exhaustion, nozzles, wash water, spray bar, sugar quality, factory process

Introduction

Sugar quality and A-exhaustion are important parameters in sugar processing. Tongaat-Hulett Sugar Ltd (THS) has established that one unit of A-exhaustion improvement can reduce undetermined loss by approximately 0.1 units (personal communications[1]). This can materialise as a gain in revenue of approximately half a million Rand for a factory similar to Felixton (FX). A simple calculation done for FX verified the above statement, using data from the 2005 season.

With sugar quality and A-exhaustion being highly dependent on curing conditions, an attempt was made to better understand the impact of different wash water systems. A trial was conducted at FX to compare the efficiency of two types of wash water systems, *viz* the current single spray versus the new multi-spray systems.

The reason for implementing the trial was to eliminate the effects of poor washing of sugar. One of the negative results from over-washing is poor A-exhaustion, due to high A-molasses purity. A specific problem at FX was the appearance of 'two tone' sugar, which was identified as low colour and high colour sugars on the sugar belt. The suspected cause of this phenomenon was poor distribution of wash water through the single nozzle spray. Whilst this may not have been the only contributor to the 'two tone' sugar, the introduction of a multi-nozzle spray bar eliminated the problem.

[1] Steve Peacock, Tongaat Hulett Sugar Ltd

Equipment

The investigation was carried out on batch centrifugals at FX. The centrifugals are Broadbent, with dimensions of 1372 mm x 914 mm, and rotating at 1000 rpm. The centrifugals currently have a single fan spray nozzle on the spray bar. The single spray nozzle sits on the spray bar, half way down the height of the basket (Figure 1).

A new spray bar with five flat spray nozzles was purchased from Broadbent. The new spray bar was designed to provide complete coverage of the height of the basket, with an even flow of wash water through all the nozzles. The spray bar was installed on centrifugal 6A (Figure 2).

Figure 1. Spray bar with single fan spray nozzle.

Figure 2. Spray bar with five flat spray nozzles.

FX has seven Broadbent centrifugals, of which two, 5A and 6A, were chosen at random for the trial. The molasses outlet pipes from these centrifugals were modified to include 12 mm pipes with valves to function as sample points. Molasses exiting the aforementioned centrifugals could then be collected individually with the modification.

The wash water being used was at a pressure of two bars and an average temperature of 85ºC.

Experiment procedure

The trial was carried out under normal factory operating conditions over a period of approximately one month, with a sampling frequency of once per day at random times. The aim of the trial was to improve the overall quality of the sugar while minimising overwashing. The quality of the sugar required was as per the industry standard of a minimum of 99.3 Pol with colour less than 1350 ICUMSA.

All centrifugals were operated with identical settings, e.g. wash water period, steam period and spin period. The only influencing factor between centrifugal 6A and the balance of the centrifugals was that centrifugal 6A was fitted with a new multi-nozzle spray bar, whereas the other centrifugals retained the existing single nozzle spray bars.

Molasses was randomly sampled on both centrifugals simultaneously and analysed. It was decided that comparative molasses purity only be used as an indication of the degree of efficiency between the two wash spray systems.

Results

The results of the trial are tabulated in Table 1 and illustrated in Figure 1.

Table 1.A-molasses purity difference between centrifugals 5A and 6A.

Sample	5A molasses purity	6A molasses purity	6A – 5A molasses purity
1	68.9	68.5	-0.4
2	72.9	73.0	0.1
3	74.7	72.4	-2.3
4	70.1	68.6	-1.5
5	72.4	69.6	-2.8
6	73.2	65.4	-7.8
7	69.3	69.8	0.5
8	73.7	69.5	-4.2
9	76.6	77.4	0.8
10	72.1	71.3	-0.8
11	70.1	69.4	-0.7
12	71.9	69.8	-2.1
13	75.0	72.8	-2.2

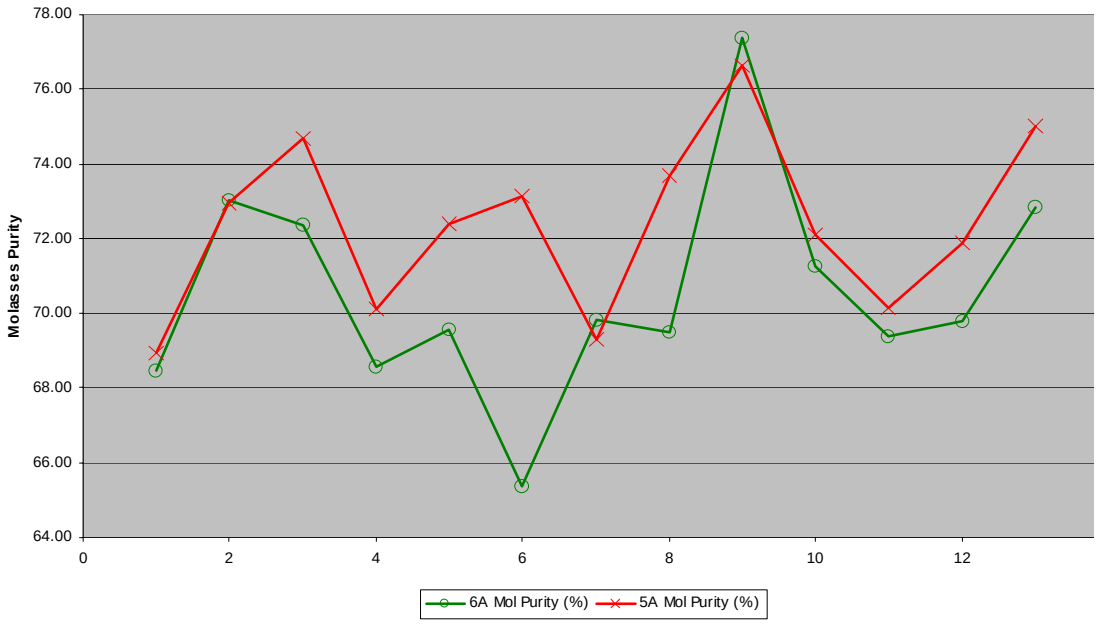

Figure 1. A-molasses purity for centrifugals 5A and 6A.

Referring to the results in Table 1, it can be seen that centrifugal 6A produced lower molasses purity than centrifugal 5A. The purity difference ranged between –7.79 and 0.75. By hypothesis testing using the student t-test, the difference in purity between centrifugals 5A and 6A was found to be statistically significant at the 5% level.

It was also found that the single spray nozzle used approximately double the volume of water for the wash period, when compared with the multi-nozzle spray bar (Table 2, Figure 2). The flowrates were obtained from manufacturer's charts.

Table 2. Spray-bar total flowrate at various pressures.

Pressure (bar)	Total multi-nozzle flowrate (litres/sec)	Single-Nozzle Flowrate (litres/sec)
1	0.87	1.82
2	1.22	2.58
3	1.48	3.17
5	1.93	4.08
10	2.72	5.77

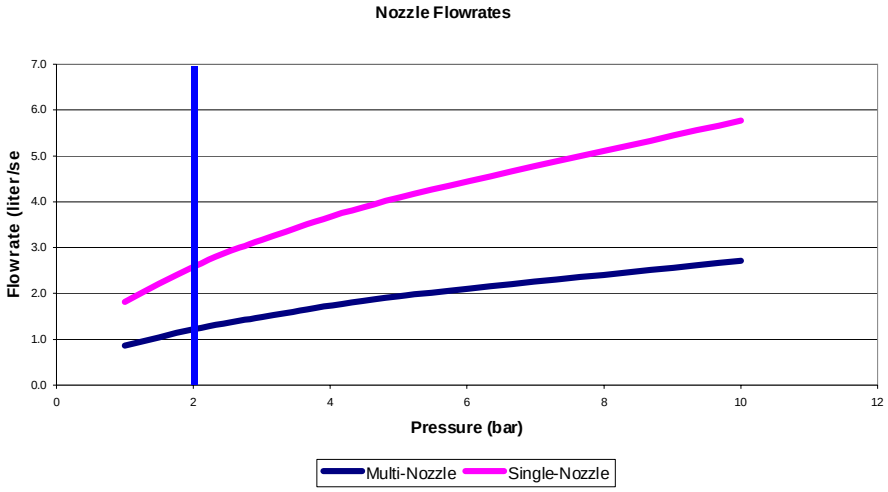

Figure 2. Multi-nozzle vs single nozzle flowrate.

Discussion

The results of the brief trial were interesting in that the multi-nozzle spray bar used half the quantity of wash water to produce 'better looking' sugar on the belt. The 'two tone' effect described earlier was not visible when centrifugal 6A discharged sugar onto the belt. Obtaining the sugar samples for the specific centrifugals was difficult under normal operating conditions, and a decision was taken to abandon sugar sampling.

The trial indicated that there was a purity difference ranging from –7.79 to 0.75 between the two centrifugals, and the centrifugal producing the lower molasses purity was the centrifugal fitted with the new multi-nozzle spray bar. With this in mind, FX fitted new multi-nozzle spray bars in all batch centrifugals during the 2005/06 off-crop, with the aim of improving sugar quality and A-exhaustion in the upcoming season.

Conclusions

The centrifugal with the new multi-nozzle spray bar produced a lower molasses purity, when compared with the existing centrifugals with single nozzle spray bars, which in turn resulted in improved A-exhaustion.

The A-centrifugal using the new multi-nozzle spray bar visually produced consistent sugar quality, while using only half the volume of water used by the centrifugal with the existing single nozzle spray bar. No ‘two tone’ sugar was produced by centrifugal 6A, which used the new multi-nozzle spray bar.

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