PERFORMANCE OF TRAYLESS FILTRATE CLARIFIER
AT KAKIRA SUGAR WORKS (1985) LTD, UGANDA

By

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KEYWORDS: Clarification, Filtrate Clarifier, White Plantation Sugar.

Abstract
A study was conducted to assess the performance of a filtrate clarifier, the first such installation in Africa. The trayless clarifier was commissioned to increase the throughput at the factory initially from 2200 to 3000 TCD with a Rapi-dorr clarifier and the following year from 3000 to 3500 TCD with an SRI clarifier. The reason for the filtrate clarifier is the fact that, during wet harvesting conditions, mud % cane can rise to well over 6%. Crushing in East Africa takes place during 11 months of the year. A comprehensive study to determine the advantages and the cost effectiveness of the unit is presented.

Introduction
Filtering the mud using rotary filters produces filtrates which are too turbid and coloured to be mixed with clear juice. The conventional procedure of returning this filtrate to the mixed juice and recirculating through the clarification system has many disadvantages, notably:
- Recirculation of sugar as well as non-sugars.
- Reduction in clarification efficiency.
- Higher mud volume.
- Reduction in clarification station capacity.

To overcome these disadvantages and increase the Rapi Dorr capacity, a trayless filtrate clarifier of a volume 18 m3/h with a retention time of 0.45 minutes was fabricated and commissioned on 17-09-2002.

Process description
The filtrate is limed to a pH of 7.0-7.5 and is then pumped through a vertical juice heater (with a heating surface area of 48 m²), heated to 102°C, and sent to the trayless clarifier.

The filtrate is treated with flocculant (4-5 ppm) and phosphoric acid (40-50 ppm as P2O5). These chemicals are added in the feed launder.

Operating results and discussion
The filtrate clarifier has performed well and, since its commissioning, the filtrate has been sent directly to the evaporators. The factory was able to maintain the target throughput of 3000 TCD. An increase in the overall capacity of the factory of 15% was achieved by eliminating filtrate recycle to the Rapi-dorr clarifier.

Samples were analysed to assess the efficiency of the system in terms of turbidity and purity of clear juice from the main and the filtrate clarifiers. The results are illustrated in Table 1. The results in Table 1 indicate an average purity rise of 1.77 units across the filtrate clarifier.

From the tests carried out, it was found that the filtrate clarifier produces juice of lower turbidity than the juice from Rapi-Dorr clarifier. The main doubt was how the unit would perform during wet conditions with poor retention of filters and high recycling of solids in filtrates. Under these unfavourable conditions, the unit performed well and the mud density was satisfactory.

The filter station is a source of high microbial growth but, by avoiding recycling of filtrates, dextran formation in the process house is reduced. Further analytical work will be carried out to establish the benefits.

Cost-benefit analysis
An economic analysis is presented in Appendix A, though the main objective of the investment was to achieve the targeted crushing rates particularly in wet periods of October/November/December 2002.
Table 1—Results of analyses of clear juice and filtrate.

<table>
<thead>
<tr>
<th>Brix</th>
<th>Pol</th>
<th>Purity</th>
<th>Turbidity (FAU)</th>
<th>Brix</th>
<th>Pol</th>
<th>Purity</th>
<th>Turbidity (FAU)</th>
<th>Brix</th>
<th>Pol</th>
<th>Purity</th>
<th>Turbidity (FAU)</th>
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<td>9.33</td>
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<td>80.19</td>
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<td>8.95</td>
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<td>82.37</td>
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<td>14.81</td>
<td>12.79</td>
<td>85.77</td>
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As can be seen from Appendix A, the estimated recovery rise of 0.02% was adopted to calculate financial returns, though the analysis of samples indicated a recovery rise of 0.15%. The assumption of a recovery rise is justified in view of lower residence time and lower inversion losses.

Conclusion

Preliminary results obtained with the filtrate clarifier indicate an improvement of the factory throughput. The unit performed well under severe wet harvesting conditions. An economic evaluation of the filtrate clarifier presented in the appendix justifies the investment.
DESEMPEÑO DEL CLARIFICADOR DE FILTRADO SIN BATEAS EN KAKIRA SUGAR WORKS (1985) LTD, UGANDA
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PALABRAS CLAVE: Clarificación, Clarificador de Filtrado, Azúcar Blanca de Plantación.

Resumen
SE LLEVÓ a cabo un estudio para evaluar el desempeño de un clarificador de filtrado, la primera de dichas instalaciones en África. El clarificador sin bateas se instaló para incrementar la producción del ingenio, inicialmente, de 2200 a 3000 TCD con clarificador Rapi-dorr y el año siguiente de 3000 a 3500 TCD con un clarificador SRI. La razón para instalar el clarificador del filtrado es el hecho de que, durante cosechas en condiciones de humedad, el porcentaje de lodo en la caña puede incrementarse hasta por encima del 6%. La molienda en África del Este tiene lugar durante 11 meses del año. Se presenta un estudio amplio para determinar las ventajas y la efectividad de costos de la unidad.

Appendix A—Economic analysis of filtrate clarifier installation

Economies of filtrate clarifier

Technical specifications
- Diameter: 3.1 m
- Height: 2.4 m
- Volume: 20 m³
- Retention: 1 h

A) Cost of in-house fabrication, erection and installation
$35 400

B) Operating Expenses

<table>
<thead>
<tr>
<th>Chemical consumed</th>
<th>Units</th>
<th>Quantity</th>
<th>Rate ($/Unit)</th>
<th>Amount ($/month)</th>
</tr>
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<tbody>
<tr>
<td>Phosphoric Acid</td>
<td>Litres/day</td>
<td>30</td>
<td>0.883</td>
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<tr>
<td>Flocculant</td>
<td>kg/day</td>
<td>4.5</td>
<td>3.57</td>
<td>450</td>
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<tr>
<td>Utilities consumed</td>
<td>t/day</td>
<td>28</td>
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<tr>
<td>Steam</td>
<td>t/h</td>
<td>179</td>
<td>0.052</td>
<td>261</td>
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<tr>
<td>Power</td>
<td>kWh/day</td>
<td>4047</td>
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</tbody>
</table>

Sub-total 1 4047

Repairs and maintenance @ 5% 147
Salaries and wages 1 operator for 1 h/day 3
Sub-total 2 151

C) Fixed expenses

<table>
<thead>
<tr>
<th>Interest</th>
<th>@ 16%</th>
<th>471</th>
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<tbody>
<tr>
<td>Depreciation</td>
<td>@ 10% Straight line</td>
<td>295</td>
</tr>
</tbody>
</table>

Sub-total 3 766

D) Total outflow Sub-total 1 + 2 + 3 4963

E) Additional revenue

Incremental recovery 0.02%
Average tonnage crushed/month 85 000 t
Incremental sugar output/month 17 t
Incremental inflow/month $7990

F) Incremental profit/month $3027

G) Payback period 12 Months (1 Year)