

BAGACILLO FLOTATION CELL

By

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Abstract

INCREASED sugarcane preparation to achieve better milling efficiency results in a significant increase in bagacillo in raw juice. For removal of the bagacillo, rotary screens and vibroscreens have gained much importance in the recent past. However, there is certain limitation for the removal of bagacillo as the screens do not allow the separation of fine bagacillo particles of size less than 0.32 mm. Raw juice generally contains some occluded air and the same when pressurised during pumping to juice heaters, gets dissolved at the pump delivery. Raw juice having dissolved air and heated up to 70°C, when released to atmosphere in a cell, causes flotation of the bagacillo. Such a concept was tried in a 150 t/h capacity sugar mill with very encouraging results.

Introduction

Bagacillo, the fine fibre component of bagasse produced due to increased cane preparation remains in the screened mixed juice. About 70–90% separation is observed with the existing static and rotary screens. Static and rotary screens are used extensively to screen fibre from juice. But static screens are less preferred and outdated due to their inconsistent performance. The particle cut-off size in a pilot rotary screen was found to be 0.32 mm. (Manson and Ames, 1982).

The residual bagacillo and other suspended matter lead to processing difficulties and finally affect adversely the quality of the product sugar (Crane *et al.*, 2004). Saccharetin in bagacillo imparts yellow colour by reacting with lime. Bagacillo can cause severe clogging problems in heat transfer equipment and centrifugals. Bagacillo is also sometimes found in product sugar. Hence, effective bagacillo removal before clarification will have a very significant benefit to produce good quality sugar. Recently, different filters have been developed to screen bagacillo content (Crane *et al.*, 2004). But these filters are associated with high energy consumption and low availability due to the need for frequent cleaning at the rated juice flow.

The fine bagacillo particles in the juice have a propensity to entrap tiny air bubbles (Crane *et al.*, 2004). This property of bagacillo helps in its separation through flotation. Further, the elevated temperature of juice releases dissolved air and the decreased viscosity results in effective flotation of bagacillo as scum in a flotation cell.

The flotation technique was tried in Deccan Sugars, a 3600 tcd sugar mill in Andhra Pradesh, India following double sulfitation process for the manufacture of plantation white sugar. Very encouraging results were obtained and are presented in this paper.

Description of the flotation cell

The flotation cell shown in Figure 1 is similar in construction to a syrup clarifier. The cell has a volume of 4.9 m³ and is operated at juice flow rate between 70 t/h to 126 t/h. The bagacillo flotation cell is placed before the liming and sulfitation process as illustrated in Figure 2. The scum is scraped by the top mounted scrapers driven by 0.4 kW motor. The scum collected in the annular chamber diverts onto the vibroscreen driven by a 1.1 kW motor, which screens bagacillo from scum. The screened bagacillo falls by gravity into the mud mingler where mud from the Graver type juice clarifier is mixed with bagacillo before sending it to the rotary vacuum filter. Juice from the vibroscreen joins the juice stream for liming and sulfitation.

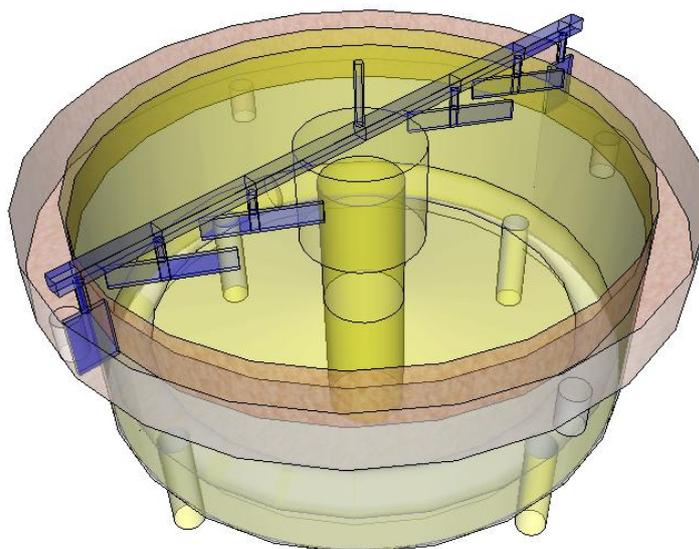


Fig.1—Bagacillo flotation cell.

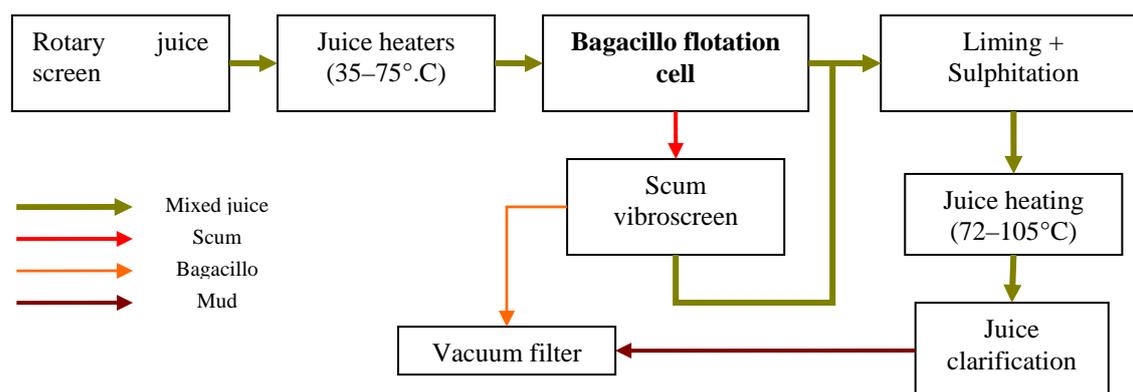


Fig. 2—Schematic layout of juice clarification with bagacillo flotation system.

Results and discussions

The bagacillo content in the screened mixed juice before and after flotation cell was measured by separating the bagacillo using an 80 mesh (175 μm aperture) size screen from a 1000 mL mixed juice sample.

The fibre content was dried to equilibrium and measured to determine the bagacillo content in mixed juice. Twenty four samples were analysed in the course of the campaign to study the performance of the flotation cell. The results are shown in Figures 3, 4 and 5.

Bagacillo content in screened mixed juice before flotation was observed to be varying from 3 to 20 g/L. This residual bagacillo content may not be fully removed in the clarification process. As noted earlier, it is often found in the product sugar.

Considerable bagacillo separation was achieved through the flotation process. Bagacillo removal in the flotation cell varied from a minimum of 8.2% to a maximum of 64%. However, 20-35% bagacillo removal was consistently achieved in the flotation cell.

The purity of the juice was found to increase at the outlet of the flotation cell indicating separation of non-sucrose components through flotation. The brix of the juice was measured using a brix spindle and the pol was measured by a Schmitz and Hanson saccharimeter.

Separation efficiency could be further improved in the existing system with minor modifications such as increasing the volume of the bagacillo flotation cell. Introduction of a nano-bubbling generator into the flotation cell to improve the efficiency of the system is also under consideration. There is, however, a possibility of higher thermal losses in the flotation cell.

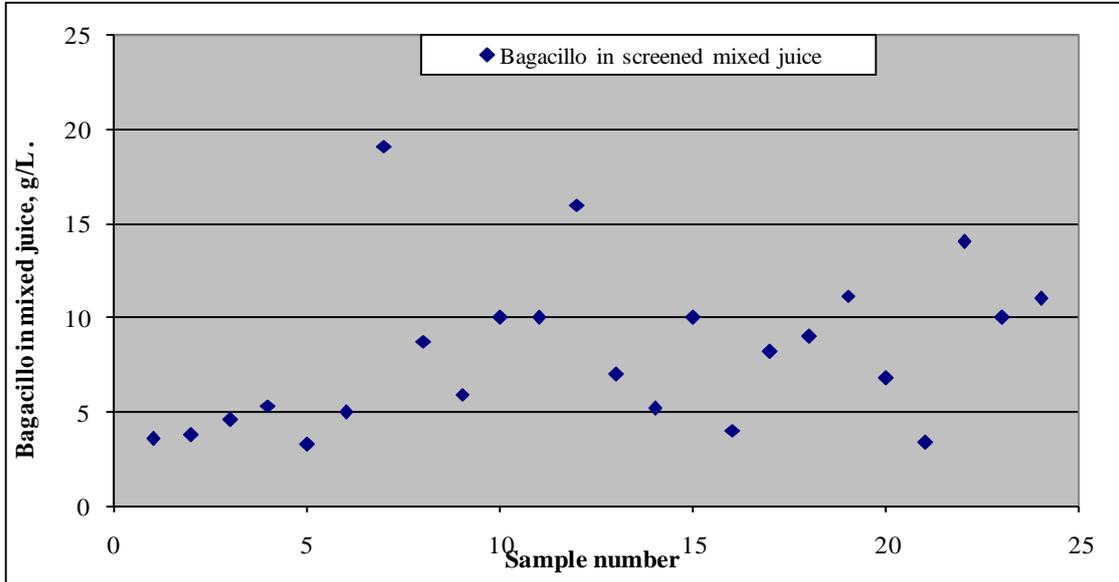


Fig. 3—Trend showing bagacillo content in screened mixed juice before flotation.

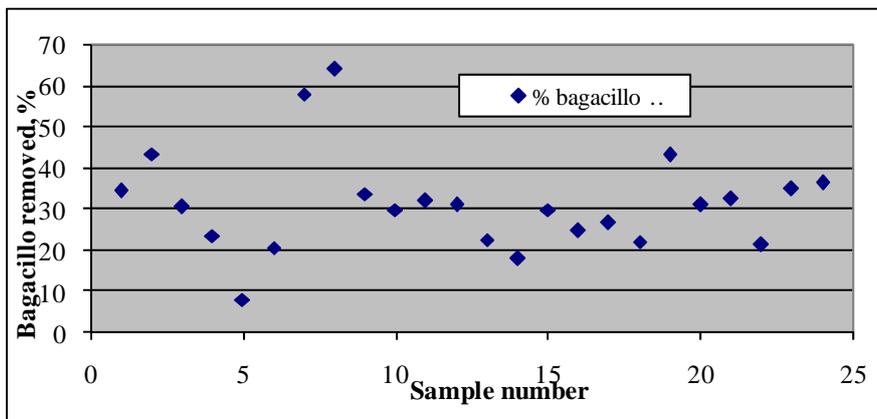


Fig. 4—Trend showing bagacillo removal efficiency of the flotation cell.

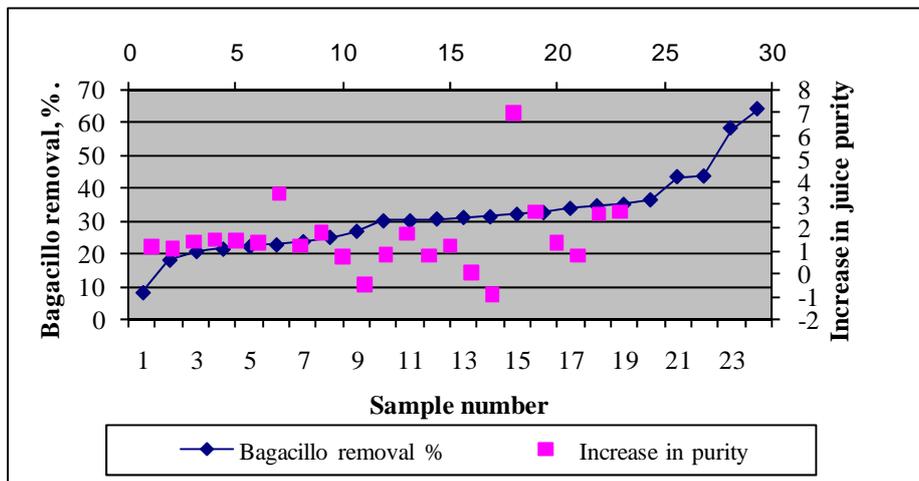


Fig. 5—Trend showing increase in juice purity with increase in bagacillo removal.

Conclusion

Through this study, it is clear that bagacillo separation through flotation is possible. The flotation cell along with diffusion system can also be installed before juice heating. Since there is no elevation of juice temperature for dissolved gases to be released, diffusion may help to impart efficient bagacillo separation.

Success of this system will increase the quality of sugar and improve heat transfer efficiency in the heat exchangers. Low efficiency juice heat exchangers can be replaced by heat exchangers having high turbulence and heat transfer coefficient.

Bagacillo flotation cell could be an economical solution to removing bagacillo content effectively. Further research and study into the mechanics of flotation is required to improve the efficiency of the flotation system.

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CELLULE DE FLOTTAISON POUR LA FOLLE BAGASSE

Par

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Résumé

L'AUGMENTATION de la préparation des cannes pour atteindre une meilleure efficacité aux moulins se traduit par une augmentation significative de la folle bagasse dans le jus. Pour éliminer la folle bagasse on se sert de tamis rotatifs et vibratoires. Toutefois, il y a des limitations pour l'élimination de la folle bagasse comme les tamis ne permettent pas la séparation des particules de taille inférieure à 0,32 mm. Le jus contient généralement de l'air qui se dissout aux pompes. Le chauffage du jus contenant de l'air en solution jusqu'à 70°C, permet la flottaison de la folle bagasse, dans une cellule, quand l'air s'échappe vers l'atmosphère. Ce concept a été étudié dans une usine à sucre de capacité de 150 t/h avec des résultats très encourageants.

CELDA PARA FLOTACIÓN DE BAGACILLO

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PALABRAS CLAVE: remoción de Bagacillo, flotación.

Resumen

EL INCREMENTO de la preparación de caña para obtener mejores eficiencias de extracción resulta en un significativo incremento del bagacillo en el jugo crudo. En el pasado reciente los tamices rotatorios y los vibratorios han ganado importancia en la remoción de bagacillo. Sin embargo, hay limitaciones dado que los tamices no logran la separación de partículas menores 0.32 mm. El jugo crudo generalmente contiene aire ocluido que es presurizado y disuelto a la salida de las bombas hacia calentadores. El jugo con aire disuelto y calentado a 0°C, cuando se lo libera a la atmósfera en una celda, causa la flotación del bagacillo. Este concepto se ensayó en un ingenio de 150 t/h con resultados muy promisorios.