

## Handling the Dirty End

In assessing most liquid purification processes, the tendency is to view the quality of the major flow, the purified stream, as the prime criteria for evaluating performance. This approach would tend to minimize the handling issues of the dirty stream that is the concentrated impurities. For a water treatment plant the sludge stream contains little of value and, as long as it does not cause a nuisance, its handling and disposal are uncomplicated.

However, the clarifier underflow in a raw cane sugar factory may contain 15% of the sugar extracted from the cane and the mud handling system must effect efficient sugar recovery as well as producing a material that can be disposed off simply. Rotary vacuum filters are the standard equipment to achieve these goals and, when balanced with the clarifier operation and mud conditioning is appropriate, can achieve very acceptable results with low sugar loss and cake suitable for disposal, best by being returned to the field, though this can be an economic challenge. Vacuum assisted belt filters with a final high pressure stage are being increasingly used, with reports of good sugar recovery and drier cake. Lower moisture cake can be achieved with secondary filtration of slurried cake after the primary filtration by using high pressure filters. This may be appropriate if there are other uses for the cake or transportation costs have to be reduced. Although technically quite feasible, the problem of such systems is the high cost and marginal benefits. At the other extreme, no separate processing of the clarifier underflow is done and it is returned to the juice extraction system. This works well in most cases if a diffuser is used for extraction and the cane is reasonably clean, but there are more problems in returning the clarifier underflow to a mill.

How many factories reduce the grinding rate when clarification (or perhaps mud handling) becomes a bottleneck? In some cases the approach would be to remove mud more rapidly from the clarifier, increase the rotational speed of the mud filter, reduce washing on the filter and return the higher brix filtrate to the limed juice system. The only other option may be to dump the excess underflow to the waste system. If the latter occurs on a frequent basis then both the filtration capacity and the mud conditioning systems need to be reviewed. Mud conditioning requires the judicious combination of pH adjustment (with lime), addition of bagacillo as a filter aid and the use of the appropriate flocculant. The goal is high porosity cake, to maximize washing efficiency and sugar recovery and also, though often regarded as less important, to maximize insoluble solids retention by the filter. With conventional rotary vacuum filters using

screens rather than cloths, clear filtrate cannot be achieved but the recycled solids level needs to be minimized.

A simple test for solids retention by the filter is to centrifuge the filtrate in a graduated laboratory centrifuge tube and measure the packed solid volume as a percentage of the total volume. This result should be compared with the solids content in mixed juice, in clarifier feed, in the clarifier underflow and in the feed to the filter. Although these results can be very useful, it should be borne in mind that the bagacillo in the mixed juice, clarifier underflow and filter feed will increase the volume measured in the centrifuge but would be preferentially retained by the filter screen however badly the mud is conditioned. Perhaps the best use of this comparative technique is in laboratory comparison of mud conditioning using the same filter screen in a laboratory vacuum filtration system. With a little effort it is possible to duplicate the filtration cycle of the factory filters in terms of cake pick up time, low vacuum juice removal and washing and final higher vacuum removal of excess moisture. Residual sucrose in the cake and insoluble solids in the filtrate can both be measured and the data used to optimize factory performance. Mixed juice can be tested in the same laboratory filter to get rough estimates of the bagacillo, defined in this case as the material retained by the filter screen, and the fine insoluble solids (field soil, clay, etc.) in the juice. Efficient precipitation and coagulation of the latter are major aspects of the clarification process. The levels of fine insoluble solids in the filtrate should not be higher than in the mixed juice.

In most operations bagacillo is screened from the final bagasse and conveyed pneumatically to the mud preparation tank. Another approach, which has the advantage of simplicity and less equipment to maintain, is to screen the mixed juice only enough to remove excess bagasse and to leave sufficient bagacillo in the mixed juice going through the clarification system to achieve good filter operation. Another advantage of this approach is that this bagacillo has been sterilized in the juice heaters, compared with the micro-organism laden material obtained from the bagasse stream.

This in turn leads to the issue of maintenance of high enough temperature in the mud system to minimize bacterial degradation. This can be significant and the purity difference between clarified juice and filtrate should not be more than 2 points. Excessive mud retention times are undesirable and has made the faster removal of underflow from short retention clarifiers necessary to obtain maximum benefits from such clarifiers. This

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interesting work by Steindl is described in the 2006 Proceedings of the Australian Society of Sugar Cane Technologists.

Unless the filter cake is weighed the determination of sucrose losses in filter cake is not much better than an inspired guess. Minimization of sucrose content of the filter cake is the only guide but I wonder whether the presence of excessive bagacillo and therefore high moisture in the cake can be misleading. We use pol % fiber in bagasse, called the "milling loss," as a measure of

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con el material a granel de micro-organismos obtenidos del flujo del bagazo final.

Esto conlleva a los temas de mantenimiento de suficientes altas temperaturas en los sistemas de tratamiento de lodos para minibar acción bacteriana degradante. Esto podría ser significativo, la diferencia en pureza entre el jugo clarificado y el filtrado no debe de ser más de dos puntos. Tiempos excesivos de retención en el lodo no son deseables al proceso, esto ha hecho la rapidez de sacar el lodo en cortos tiempos, como los clarificadores de corto tiempo de retención, necesarios para obtener los máximos beneficios de estos clarificadores, este interesante trabajo esta descrito en 2006 por Steindl, en los Procedimientos de la Sociedad de Técnicos Azucareros de Australia.

A menos que la torta sea pesada, la determinación de las pérdidas de sacarosa en un filtro de cachaza, no son más que una aproximación "inspirada." La deducción del contenido de sacarosa es una única guía, pero me pregunto si la presencia de exceso de bagacillo y altas humedades en la torta puede distorsionar los resultados. Usamos el dato de pol. % fibra en bagazo, "llamado" pérdidas en molienda, como una medida de del comportamiento de de la extracción, ya sea en un Molino o

extraction performance by the mill or diffuser. Should we use pol % dry solids in filter cake as a measure of the filter performance? If this value is higher than the pol % fiber in bagasse, are we increasing losses by adding (excess) bagacillo? Some bagacillo is essential but are we increasing the quantity of filter cake too much if we use excess bagacillo? Would it make sense to know the percentage of fiber (bagacillo) in filter cake as a function of the sucrose in filter cake?

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en Difusor. ¿Podríamos usar pol. % sólidos secos en la torta del filtro como una indicación del comportamiento del filtro? Si este valor resulta más alto que el pol. % fibra en bagazo, ¿podríamos pensar que si no estamos aumentando pérdidas de azúcar por aumentar (excesos) de bagacillo? Algún bagacillo es esencial, pero ¿podríamos aumentar la cantidad de torta en demasiadas cantidades si usamos exceso de bagacillo?

¿Podría hacer sentido el conocer el porcentaje de fibra (bagacillo) en la torta del filtro como una función de la sacarosa en torta?

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