

Experience with Auto-Jet Filters

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Despite the fact that sugar is the most pure food obtainable, specifications of many industrial users are very exacting. Trace impurities become problems of gross magnitude in their processes. Soluble trace impurities are, principally, a function of white pan purities, which, in turn, are dictated by process economics. Insoluble trace impurities are, of course, related to the effectiveness of thick juice filtration. Two campaigns of operating experience with "Auto-Jet" filters at Santa Ana, demonstrated that filtrate quality and filtration economics were both improved.

As the new filter station has been previously described (1), this paper will be confined to the operational results and techniques of the two campaigns of 1955.

Nearly 800 filtering cycles with the "Auto-Jet" filters have generally confirmed previously reported results (2).

1. Filtrate quality is excellent.
2. Flow rates of 7 to 8 gph/sq. ft. are optimum.
3. Cycle times are normal.
4. Reliable asbestos precoat filter media is easily applied.
5. Filter cakes are quickly and thoroughly sluiced away.
6. Sluicing creates no objectionable disturbances for the beet end.
7. Scale accumulations, which tend to decrease filtering efficiency, are easily removed.

Filtrate Quality

Indices of comparison of filtrate quality were visual sediment discs on all strikes and bacteriological tests on bottlers sugars. Sediment discs are prepared on each strike as a routine control measure. Comparison of 1954 tests with those of 1955 showed a marked improvement. Almost without exception, each of the 1955 strikes were superior to the most exacting specifications.

Bacteriological data provided a more quantitative measure of filtrate quality. Although the sanitary measures throughout the mill were equally good in the 1954 and 1955 campaigns, the data indicated a marked improvement in the number of reject strikes.

	1954	1955
Total strikes tested	264	247
Reject strikes	82	11
Percent reject strikes	31.1	4.5
Average count in all strikes	559	70

Considering that bacteria are in the micron size range, a rather tight filter media was established and maintained on the new filters. On the other hand, permeability was maintained, as verified by the normal filter cycle times. Several factors were responsible for this desirable condition, namely, a proven precoat procedure, minimum abuse of the filter cake, and a favorable personnel situation.

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² Numbers in parentheses refer to literature cited.

Personnel

Once the system was settled into its simple routine, it was felt that if a full time operator were needed, a second class station classification would be proper. However, only a few minutes of direct labor were required per shift, thus, the beet end foreman or the extra man performed the necessary details.

With the installation of the "Auto-Jet" filters, interest in the new equipment ran high. As a result, there was an almost unnoticed refresher course in filtration among the plant personnel. These two situations created a very favorable personnel condition. The new system was immediately and closely integrated with the rest of the factory processes.

This unexpected use of top caliber personnel was an intangible, but nevertheless, positive benefit with respect to station performance. As the foremen operated the station incidental to their other duties, there was no direct labor charge to the filters. A very tangible economic benefit is obvious.

Precoating

Hydraulic application of a reliable filter media of asbestos and filter aid is predicated upon filling the filter shell with a filtered syrup before circulating the precoat slurry. In this way, the precoat material enters the filter and immediately deposits evenly upon the leaves.

For the first thick juice filters, $7\frac{1}{2}$ pounds of grade 50 asbestos was added to about 250 gallons of previously filtered juice. The asbestos was most evenly dispersed by a 3 minute circulated flow through the precoat pump and directly back to the precoat tank. Simultaneously, 50 pounds of filter aid (JM Celite 512 or Dicalite Special Speed Flow) was slurried in about 125 gallons of juice in another mixing tank.

The asbestos slurry was then circulated through the filter at a high flow rate for 3 minutes. The filter aid slurry was then added to the precoat tank and circulated for another 8 to 10 minutes, although excellent clarity was obtained in 5 to 8 minutes. The flow rate was then reduced to normal, and filtration of melter syrups was begun immediately.

For refilters, the procedure was identical except that 10 pounds of asbestos fiber were used.

Filtering

Permeability of the filter cake was maintained by avoiding abuse of the cake. Abuse was minimized by consideration of solids conditioning, optimum flow rates, even density feed syrups, gradual pressure changes, elimination of air, and a continuous and even flow.

To reduce the disturbing influence of air passing through the cake, the filter shells were continuously vented. The melters, pumps, and recirculation systems were modified, where possible, to reduce entrapment of air in the filter feed slurries.

Recirculation of the filtered juice (1, 2) provided an even, continuous flow, despite irregularities in materials entering the high raw melter. Sudden pressure changes were thus avoided.

During the first few weeks, a flow recorder controller aided in evaluation of the filters and confirmation of desirable or optimum flow rates. Filtering times were about 24 hours for the first filters and 80 to 140 hours

for refilters. Flow rates of 7 to 8 gph/sq. ft. were about optimum. Flow rates as high as 12.5 are possible, but cycle times are seriously shortened and filtrate quality is less assured.

With respect to avoiding excessive flow rates, maintenance of full filtering area was a temporary problem. The longer cycle times for refilters permitted time for some organic type scale formation. This scale is common to all types of filters operating on high density melter syrups. For example, this is indicated on plate and frame filters by the loss of softness and pliability of the textile media and by scale accumulations on the plate faces and in the drainage channels.

With the "Auto-Jet" filters, a slow but progressive blinding (due to scaling) was noted on the refilter screens. Fortunately, however, a 1-hour hot caustic recirculation through the filter removed the scale and restored the full filtering area of the screens. Present experience indicates that a caustic cleaning at about 4-week intervals would assure a high level of filter efficiency.

For evaporation economy reasons, high density syrups are desirable. Poissuille's basic filtration equation warns us, however, of the adverse effects of viscosity upon flow rates. As should be expected, high densities present problems with any filter.

Although a filtering temperature of 98° C. aided in depressing viscosity, there was difficulty in filtering syrups with a Brix much above 65° (hot). At the relatively high-flow rates used (7-8 gph/ sq. ft.) the Brix of the syrups averaged 71.5 (corrected) for the two campaigns.

If much further improvement in syrup density is to be made, it must come primarily from measurement and control of viscosity. Some test work at Alvarado has indicated promise in this respect.

Solids conditioning of the syrups was, of course, continuously reviewed. Filter aid addition to the melters was readjusted, as necessary to maintain the cake porosity, depending upon the beets and the carbon addition. Facilities were provided to add the carbon and filter aid to the high raw melter in a regulated and continuous manner. Filter aid to the refilter supply was also regulated.

Sluicing

A thorough cleaning of the leaves was assured with 3 minutes of sluicing. Only 1,000 to 1,100 gallons of thin juice were used as the sluice fluid. The sluiced cake was drained to the carbonation Oliver filter mud tank. This system caused no dilution to the beet end and no appreciable disturbance to the Oliver filters.

Following the campaign, the leaves were all examined. The first filter screens were discolored but not blinded. The refilters had a small percentage of scale blinded area. A caustic treatment, a five-minute, dilute-muriatic acid rinse, and a final soda neutralizing rinse removed all organic and carbonate scale. The screens were then as bright and clean as when initially installed.

References

- (1) COSSAIRT, G. W. 1955. Self-sluicing unit points way to pushbutton filtration. *Food Eng.* 27:59-61.
- (2) COSSAIRT, G. W. 1953. Observations on leaf type filters, Calif. Field Crops Tech. Conf., Opr. Dept. Session. 69-118.