Ion Exchange Operations—Hardin 1949 Campaign

J. E. MAUDRU[1]

Ion exchange operations at the Hardin plant during the 1949 campaign were quite satisfactory. The ion exchange operated almost continuously during the 86-day campaign with practically no mechanical difficulties. The flow of the juice to ion exchange was restricted to 80-85% of the total so that the beneficial buffering effect of the untreated 15-20% could be realized. pH loss through the evaporators at Hardin has been a problem and the use of excessive soda ash has been necessary. The 15-20% juice

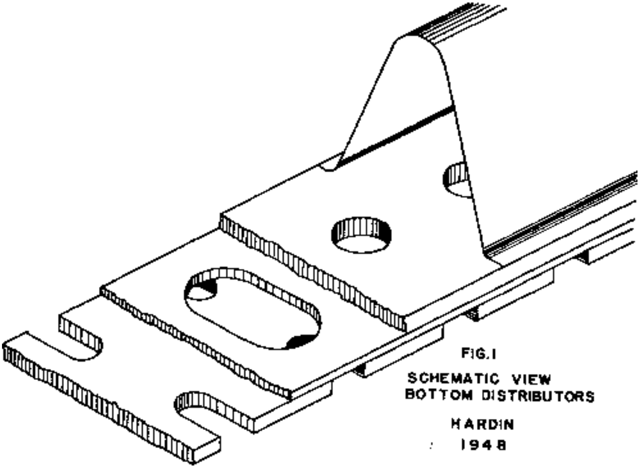

FIG. I
SCHEMATIC VIEW
BOTTOM DISTRIBUTORS
HARDIN
1948

bypass greatly diminishes this pH loss and soda addition. During the first part of the campaign 2nd carbonation juice constituted the influent to ion exchange, while during the last part of operations the juice was sulfured before being pumpd to ion exchange. The comparison of these two methods will be discussed later in the paper.

The only mechanical change in the ion exchange plant from the 1948 campaign was the bottom distributors. In 1948 a distributor diagrammed in Figure 1 was employed. This is composed of 3 strips of synthane, the

[1] General Chemist, Holly Sugar Corp., Colorado Springs, Colorado.

bottom strip being 3/16" thick, middle .018", and the top 1/8". The orifice is formed at the inside of the middle slot. The collector trough rests on top of the 3 synthane strips. It is made of rubber-covered stainless steel and conducts the juice from the orifices to a main juice trough along the diameter of the cell. There are 12 bottom distributors in each cell. The small tunnels ahead of the orifices plugged with resin so that excessive pressure drops through the distributors were encountered. Only about 50% of the juice was treated in 1948 due to this difficulty with distributors. During the 1949 intercampaign these distributors were replaced with a type having the orifice at the edge of the distributor, thus eliminating the tunnel. During this last campaign no trouble was encountered with excessive pressure drops or plugged beds. Figure 2 shows a typical head loss curve through both cation

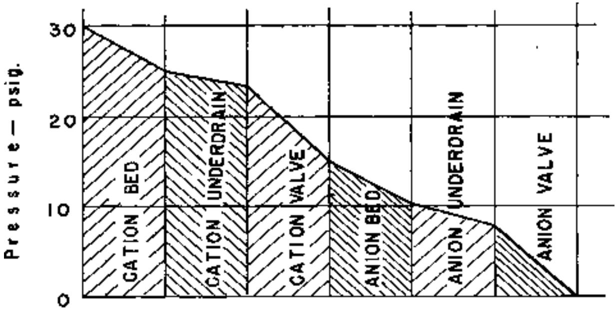

Figure 2

PRESSURE DROPS THRU ION EXCHANGE SYSTEM

Service Cycle

450 gpm.

and anion cells. The large head loss through the conoflow valves indicates of course, that the valves are throttled to maintain level. All figures are compensated for static head.

For the first time, last campaign, bacteria troubles were encountered. The infection took place in the heat exchangers and was actually more troublesome mechanically than from a sugar loss standpoint. The dextran material produced by the bacteria plugged the small passages of the heat exchangers so that frequent steaming out was required. No bacterial action was noted in the resin beds although they were sterilized several times using dilute formaldehyde after the method of Cruikshank &: Braithwaite[2]. After starting to sulfur the feed to ion exchange this bacterial trouble diminished greatly, showing that the $S0_2$ in the juice exhibits some bactericide action.

[2] Cruikshank, G. A., & Braithwaite, D. G., Ind. Eng. Chem. 41, 472-3, (1949)

While 2nd carbonation juice is undoubtedly sterile due to the time-temperature and pH to which it has been subjected, the infection probably developed in the heat exchangers and never was completely eliminated in the steaming operations. The use of SO_2 paid for itself many times over in greatly reducing this problem.

We have always been concerned at Hardin about gypsum fouling of the cation resin due to the high calcium content of the Hardin water supply (6 gpg of Ca) as Ca (55 gpg total solids). During operations a cation bed was regenerated in the Na cycle with salt and then with acid. No increase

Table 1.—Ion Exchange Operating Data—1949. 1949 Campaign.

	Influent to Ion Exchange	Effluent from Ion Exchange
Brix	11.1	8.0
% Sugar	10.04	7.76
Apparent Purity	90.4	97.5
pH	8.8	8.4
Conductance uuhos	2849	628

Lb. Acid per Ton Beets	26.82
Lb. Acid per Cu. Ft. Resin	2.40
Lb. Ammonia per Ton Beets	8.05
Lb. Ammonia per Cu. Ft. Resin	.72
Non-Sugar Removal	75.66
% Dilution	23
Sugar in Molasses % on Beets	1.26
Cu. Ft. White Mass per Ton Beets	8.16
Cu. Ft. High Raw per Ton Beets	4.45
Cu. Ft. Low Raw per Ton Beets	1.23

in capacity after this treatment was noted and so it was concluded that no capacity was being sacrified on account of gypsum fouling.

Sugar end operations at Hardin were quite satisfactory and very little trouble with gummy low raws was experienced on the sugar end. Molasses production was not excessive and was about what pre-campaign calculations indicated. A typical white sugar analysis is as follows:

Ash %	.0088
SO_2 ppm	2
SO_3 ppm	2
Solution Grade	94

While the 1949 operations leave much to be desired, they are an improvement over previous years mostly due to the improved bottom distributors. An attempt was made to treat ion exchange just as any other station in the factory and to allow the local factory management to make the necessary decisions about operations and to integrate it into its proper place in relation to the other mill stations. In this we were highly successful, and plan to continue the program next year.