Handling and Treatment of Dried Beet Pulp

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Among the problems encountered when the project at St. Hilaire was inaugurated was the problem of drying and handling of beet pulp. Most of the difficulties of drying were due to inexperience of the personnel and the normal difficulties incident to starting a new factory. Although conditions in this respect gradually improved, certain minor troubles were experienced in the bagging and earring of the pulp.

Due to the fact that we were operating the original Silver Diffuser, certain characteristics were noted which had not previously been encountered. It was found advantageous to supply the diffuser with extremely fine cossettes, often of a fineness giving *in* excess of 30 meters/100 grams. Probably due to the low temperature employed in the diffuser, the dried pulp was extremely tough and wiry and had a weight to volume ratio of only 7.5 lbs./cu. ft. There were times it was impossible to get a 100-lb. fill in the largest bag obtainable. This condition was intensified by the fact our pulp received very little mechanical handling, going by short screw conveyor direct to the elevator and by means of another short screw conveyor to the bagging station.

During cold weather another difficulty was encountered which we believe has always presented itself to manufacturers of beet pulp. This was the so called "sweating" of the pulp which we believe was caused by condensation and rehydration. Since this condition was sometimes worse than at other times without any apparent explanation, it was assumed that, under certain conditions which were not determined, the pectin in the pulp was quite readily rehydrated.

The remedy normally employed was to store the pulp in the warehouse for two or three days *in* low piles after which it was loaded in cars, involving considerable extra expense. The thought then occurred that if the pulp could be cooled before bagging and some of the residual moisture removed this trouble could be eliminated.

A machine was developed whereby the pulp was passed over a series of perforated screens with a counter-flow of air, as indicated in Figure 1. When this machine was perfected it was found that a cooling of 10° to 20° C. was obtained as well as a reduction in moisture of from 2.49 percent to 3.74 percent, depending on the moisture leaving the drying drums and the relative humidity of the air admitted to the cooler. This drying action was found to be of special value when the pelleting of the pulp was undertaken, about which more will be said later. It also made it possible to reduce the temperature of the gases leaving the drums by as much as 20° C. with a consequent saving *in* fuel.

Figure 2 indicates the relation of moisture before and after the cooler at various moisture content and Figure 3 indicates the relation of moisture leaving the drying drums and at the bagging station. The difference can be accounted for as due to drying action during handling other than cooling operations. Since the introduction of the cooler, pulp has been loaded directly into the cars without a single instance of "sweating" action.

The cooler is powered with a 10 h.p. motor. About 2,200 cu. ft. of air per minute are drawn through the cooler at an average relative humidity of

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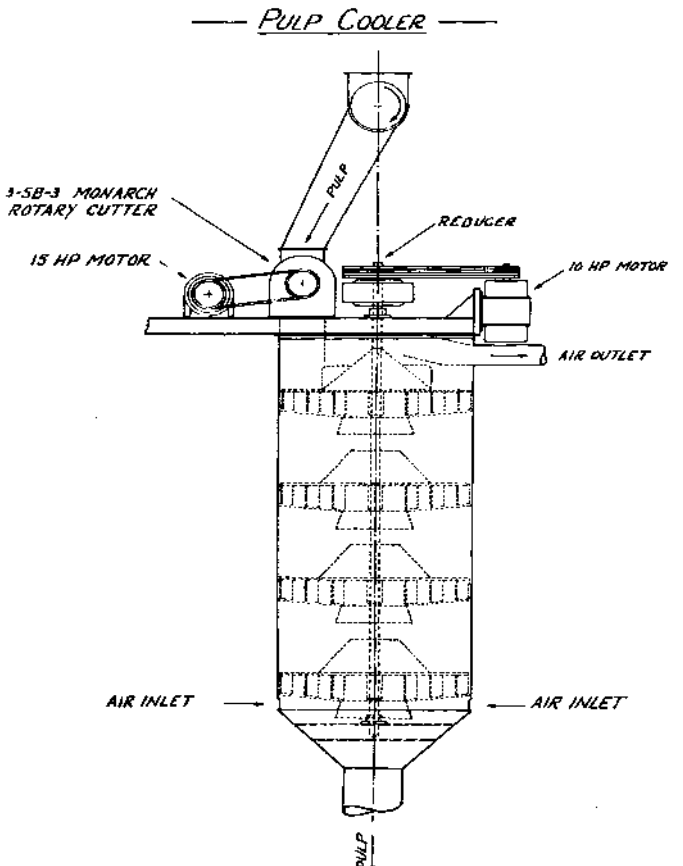
PULP COOLER
3-SB-3 MONARCH ROTARY CUTTER
15 HP MOTOR
PULP
REDUCER
10 HP MOTOR
AIR OUTLET
AIR INLET
AIR INLET
PULP

Figure 1.

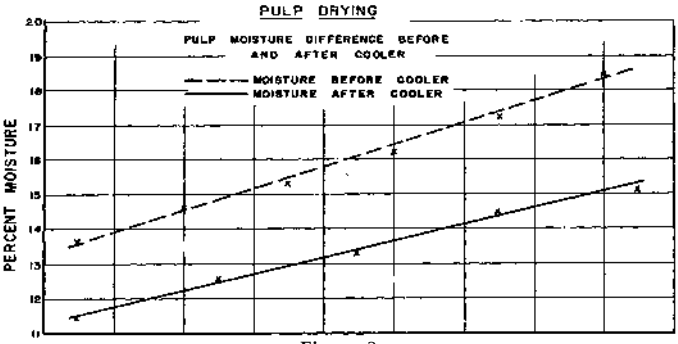

Figure 2.

50 percent, which is equivalent to 44,000 cu. ft./ton of pulp. A sufficient breaking action occurred in the cooler to density the pulp to the point where 100 lbs. could be filled in a 36" x 54" jute bag.

The next problem which arose was the scarcity and the extremely high price of jute bags. It was decided to convert to 50-lb. paper bags as had already been done by certain other producers. For this program a further densification of the pulp was deemed necessary and was accomplished by the use of a Sprout-Waldron 3-SB-3 Monarch rotary knife cutter placed ahead of the after cooler. Certain other producers were already using this machine and we therefore claim no credit for this introduction. This machine is powered by a 15-h.p. motor and has a capacity of approximately 2.5 tons/hour, the density of pulp before cutting being 7.25/cu. ft. and after cutting 11.5 lbs./cu. ft. or an increase in density of 37 percent. After densifying it was quite easy to fill 50 lbs. of pulp into an open mouth paper bag of 21" x 7" x 53" dimension.

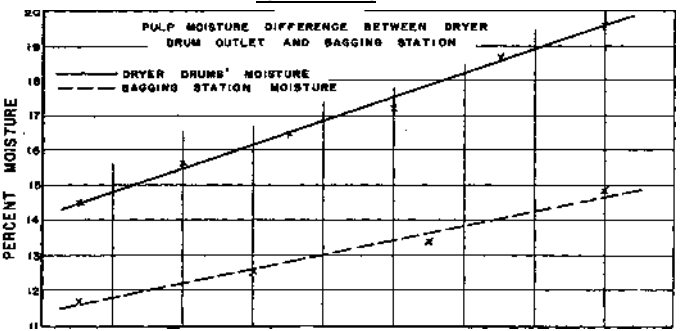

Figure 3.

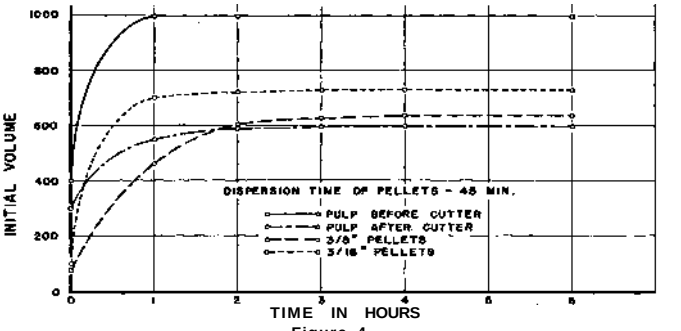

Figure 4.

The next project undertaken was the pelleting of dried beet pulp. At least one trial had been reported by another producer with favorable results. After conferring with a manufacturer of pelleting equipment, some of our pulp was successfully pelleted in a machine owned by a large cooperative in Montreal. Later on installation was made consisting of a Sprout-Waldron 501 "Simplex" pelleting mill, a pellet cooler was built at the plant to plans supplied by the above Company and a 4' x 6' vibrating screen for the removal of fines from the pellets. After the equipment was put into operation, certain revisions were required on the feeding and conditioning compartments of the mill. After these revisions were completed, pellets were successfully made, using both 3/16" and 3/8" diameter die.

It was found possible to pellet pulp at a moisture content of from 14 to 17 percent, the optimum content being in the 15 to 16 percent range. The machine is equipped with a conditioning compartment wherein steam is introduced to bring the pulp to the desired moisture and temperature. It was here that an additional value of the after cooler was found. If pulp was sent to the pellet mill at the normal moisture content of 12 percent, the steam requirements for conditioning were excessive and, in fact, the capacity of the conditioner was inadequate. Another complicating factor was the fact that the single mill installed could handle only one-third to one-half of the pulp produced.

The solution was to bring the pulp from the drums at approximately the right moisture content for pellet operations. For the remainder of the production above pellet mill capacity, sufficient additional drying was obtained in the after cooler to render it suitable for bagging. The optimum temperature for pelleting was found to be 180° to 185° F. The moisture of the pellets leaving the mill averaged 14 to 16 percent, and leaving the pellet cooler 10.5 to 13 percent.

The 3/16" pellets had a density of 38 to 40 lbs./cu. ft. and the 3/8" pellets 37 to 39 lbs./cu. ft. It was found possible to fill 100 lbs. of either size into an open mouth paper bag of 17.5" x 4.5" x 41", costing considerably less than a single 50-lb. paper bag. The space required for storing and shipping the pellets is less than one-third of that for unpelleted pulp. Pellets are well adapted to bulk storage and shipping.

It was found advisable to determine the time required for dispersal in water of these pellets and also to what extent the time required for rehydration was affected as compared to unpelleted pulp. The time required for complete dispersion for both the 3/16" and 3/8" pellets was 45 minutes.

BEET PULP PELLETING CAPACITY

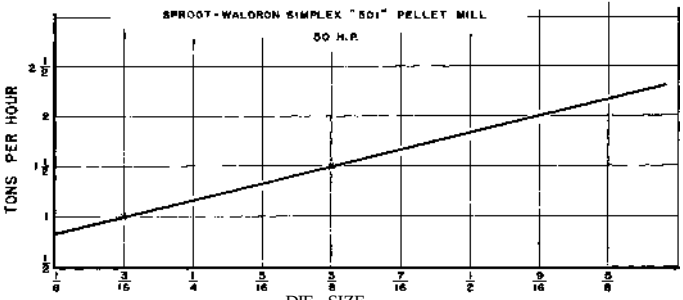

Figure 5.

Figure 4 shows the time required for complete rehydration of pulp before and after cutting the 3/8" and 3/16" pellets. This graph indicates that the total rehydration time of the pellets is *in* direct ratio to their diameter. As yet the use of additives in pelleting operations has not been tried but is being considered. The cost of pelleting per ton of pulp was found to be as follows:

Labor	$ 1.00
Electric Power	.12
Steam	.04
[2]Miscellaneous	.25
Total	$ 1.41

On the basis of the 1951 campaign, comparative costs for bagging and handling dried beet pulp *in* various forms and containers were as follows, using cost of bagging and handling in 100 lb. jute bags as 100:

Pulp *in* 100 lb. jute bags	100 %
Pulp in 50 lb. paper bags	48.3%
Pellets in 100 lb. paper bags	22.5%

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[2] Includes maintenance on equipment.