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Improve the extraction efficiency of a tandem sugarcane mil

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***Abstract*— *This project was implemented in Sugar Mill San José de Abajo S.A de C.V., in which there were problems due to sugar losses (Pol), this process is located in the department of mills (extraction). Through the investigation, important data were obtained on the losses of Pol in bagasse, which is very significant for the company. Through the literature we were able to document the adjustments, values, parameters, among other factors that influence good extraction, in order to reduce losses and generate improvements to the process for the benefit of all. The results of the 2016-2017 harvest were analyzed in order to seek improvements, which with hard work and effort were proposed and considered by the technical staff, and which could be used for the sugar industry.*

***Keywords*— Pol, efficiently, sugar production.**

I. INTRODUCTION

In the sugar mill object of this study, it shows production losses in the extraction area and in the crystallization process. The capacity installed in the area of mills is up to 800,000 tons of cane per harvest, which lasts approximately six months.

It is important to clarify that the mill area is limited to extract the juice of the sugarcane, however the sugar also known as POL or Sucrose, must be extracted from the fibrous cells, this leads to devise strategies for the maximum extraction of POL.

In the 2016-2017 harvest season, 609,826,704 tonnes of cane with average percentage of 0.890% lost of POL in the bagasse. The above represents the grinding of 1,256,243 tons of sugar and a cost of $ 12,000.00 per ton.

OBJECTIVES

Increase the efficiency of a mill tandem by adjusting the operating parameters to the extraction area, according to the standard indicators.

Specific objectives

To achieve the POL index in bagasse and adequate humidity, the following actions will be carried out:

- Adjust the dimensions of the clubs.
- Adjust hydraulic pressures appropriately.
- Improve the sanitization (disinfection) of the mills.
- Improve the training of workers.
- Correct the flow and temperature of the imbibition water.

The current situation of the company was investigated through surveys carried out with engineers and workers from different areas, and the results obtained by the company's laboratory were analyzed.

To determine the possible causes of the current POL losses, quality tools were used. Below is the diagram of the possible causes:

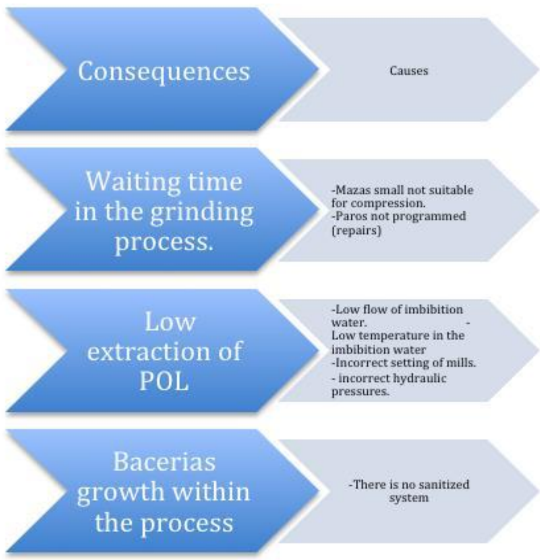

Fig. 1: Causes of lost POL

The above factors allow locating the inefficiency causes. With the aim of reducing the inefficiency of the productive processes, grinding is planned before the beginning of the harvest considering the following parameters:

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- Reed to be milled in tons.
- Losses of Pol in bagasse (tolerable).
- Business days.

Studies carried out by Hugot in 1986, show that the water of imbibition must be double the percentage of fiber, this means that if the percentage of fiber cane is 13.659%, then 27.310% of water will be applied.
Currently, between 90 and 100 tons of steam are generated at a temperature of 260 ° C.
The hydraulic pressures and torque applied to the upper hub can range from 2100 to 2500 pounds per square inch.
The recommended dimensions for the club are:

- 35 ° angle
- Step of 1.5 "
- Diameter of 37 "
- Length 66 "

From a good preparation of the cane it is possible to extract between 60% to 75% of the sucrose in a first conventional mill, if the cane goes to a second mill is little juice that has been left in the bagasse therefore the recovery of sucrose will be much less.

II. RESEARCH PROPOSAL

Figure 2 shows the quantity of POL planned in the 2016-2017 harvest.

Parameter	Planned	Real	Difference
Tons of ground cane	750,000.01	609,826.704	140,173.306
POL	0.684	0.890	0.206
Tons of sugar	84,030	63,987.250	20042.75

Fig. 2: Causes of lost POL

It can be seen in figure 2 that the request of POL planned against the real is 0.206, the foregoing indicates that even if it took advantage of the bagasse in the boilers.
Now, if these losses of Pol are transformed to economic losses, taking as a reference the Pol made sugar we will obtain the following.

$$ugar\ lost = \frac{(Tons\ of\ ground\ cane)(Difference\ of\ POL\ loss)}{100}$$

Substituting the values in equation 1 we have:

$$ugar\ lost = \frac{(609\ 826.704)(0.206)}{100} = 1256.243\ ton$$

To calculate the economic loss it is considered that the price of the ton of sugar in the market is 12,000 Mexican pesos, then 15074916.1 Mexican pesos are lost.
There is a method to extract more Pol, this process is called imbibition water; consists of mixing the imbibition water with cane juice that remains after passing through the first mill.
The above dilutes the Pol contained in the bagasse and creates a material that can be compressed by the mill.
Hugot (2012) "the mills take the bagasse more easily than dry".
One ton of cane contains 13.659% fiber, using the method assumed by Hugot the following amount of water should be applied:

$$13.659\%\ x2 = 27.318\%$$

$$1000\ kg(0.27318) = 273.18\ kg$$

The milling capacity per hour of the sugar mill studied is 185,809 tons of cane per hour, then 50,759 tons of water per hour must be applied.
Another factor in the process of imbibition is the temperature of the water, Hugot (2012), "the experiences made with respect to the use of cold or hot water agree little, however, in certain factories can be checked a marked increase in the exhaustion of bagasse, when hot water is used. It seems that the temperature does not has no effect until it reaches 60 ° or 70 ° ", from this point on the efficiency of the imbibition is remarkably better with hot water.
The sanitizing of the mills is used for the elimination of bacteria that can harm the manufacture of sugar, the "tíbico" is the main bacteria to eliminate and prevent its reproduction, this bacterium feeds on the Pol that contains the cane.
Unfortunately the company does not have an organized sanitation system; irrigation pumps manually sanitize the mills at different times.
During the process of cane milling, it is important to avoid the production of reducing sugars.
Analysis of the results Through the implementation of the proposed solution, the following results are obtained:
Elimination of 96% of bacteria through steam sanitization, the remaining 4% will be eliminated by the application of a bactericide.
The rate of pollution in the tandem by reducers is 0.126, therefore the economic recovery will be:
(609826.704)(0.00504)/100 =30.73 ton
It will be possible to recover $ 8, 851,800.00. The cost of the system is not yet negotiated, however some mills that count on this system comment that the cost of this does not exceed approximately 3.5 million pesos, this system will allow this recovery in a harvest season (6 months).

III. CONCLUSION

As part of the strategies to maintain and improve the efficiency of the sugar mills, it is recommended to adjust the hubs and grease them according to the manufacturer's specifications. The previous things so that the maces support the hydraulic pressures that allow obtaining the greater percentage of POL.

The proper temperature of the imbibition water is 75 ° to 90 °, another important point is the training of operative personnel in the imbibition system.

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