

Review of Design and Optimization of Fibrizer in Sugar Cane Industry

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Abstract

Sugar cane factories began moving away from cane roller crusher in favor of cane fibrizer for achieving good cane preparation for extraction of juice from cane. Three main processes have done on it, cane-knifing in chopper, cane-crushing in fibrizer, extraction of juice in milling. As per the capacity of plant, fibrizer are changing in size & model, so which will be result in high preparation index (PI). In this project swing-hammer type fibrizer is used, this will be result in high preparation index (90+PI) & optimizes in power consumption and cost. Purpose of this fibrizer is, sugar factories needs keep up with this technology & take advantages of less expensive, more reliable fibrizer drive design which will easy in maintenance and operation. Thus Optimization technique give idea about material selection, cost reduction, power consumption, using this data it will give benefits for process. Experimental data will be compared to theoretical for further study, so it will raise technology and helpful for sugar cane factories.

Keywords: Cane, Optimization in fibrizer, Redesign, Swing hammer type, sugar cane Industry.

1. Introduction

The equipment now generally used after knifing to complete the preparation of cane for extraction plant is fibrizer. But this has only been so over the past 20 to 60 years in most cane factories. Previously, initial knifing was followed by heavy crusher to break the cane further, but in this process much of cane was not properly prepared thus power consumption and losses were happened in factories. On overcome these issues lots of study have been done & technology upgraded in industries. Factories are using fibrizer which produce high levels of preparation (greater than 85PI) & less consumption of power in processing. Previously, steam turbines were used for roller crushing instead of electric motors, now a day slip ring motors with high capacities are used for better operation & less

maintenance, low power consumption. In this type rotating high speed hammers impacting on Cane to rupture it and open fiber cells for further milling process. In this fibrizer hammers are pivoted to hubs and hubs are mounting on shaft which will rotate on high speed, this whole assembly is covered by means of hose. Hammers size, material for hammers tips, shape of hammers & weight are considerable, also anvil plates, grid plates are parts of fibrizer assembly. Cane shredding is also depending on clearances of anvil plates, too much of clearances result in bad preparation and less clearance result in break of hammers tips and choking. Grid plate can be rigidly secured but most of engineers prefer to allow for fail-safe mechanism in the event of large tramp iron or an excessive surge of cane. Mechanisms to allow the grid plate to move rapidly away from the rotor under such circumstances include pneumatic, hydraulic or spring type. Two objectives can best be achieved by use of swing-hammer type fibrizer are that canes are prepared better for achieving preparation index & operation have done in minimum potential energy and power. This total assembly is easy to mounting so that maintenance, performance, operation is simple & greater for sugar factory. Thus behavior of swing-hammer type fibrizer has become proper subject for study. S.T. Inskip [1] has studied that there are genuine advantages to be gained from installing an fibrizer in terms of energy savings, installation and civil costs, maintenance savings and co-generation benefits that will factories to operate at higher level of efficiency. Hall DJ [2] replaced old motors with reliable, medium voltage and low maintenance, variable speed drives connected to robust to simple squirrel cage motors. Researchers [3-5] studied life of hammer and new material for long life of hammer.

2. Tables, Figures and Equations

2.1 Tables and Figures

In below table 1 average results are given for progression of preparation and power usage (increase in preparation is given in units of POC because POC is itself a percentage).

Table 1: Average results for the progression and power usage through the shredder [3]

Shredder Configuration	Preparation (POC)	Specific power (kW.h /t)	Increase in Preparation (POC)	Increase in specific Power (%)
Hammers	73.38	2.63		
Front wall	80.91	3.56	7.5	35.4
Grid bar	89.79	5.80	16.4	120.5

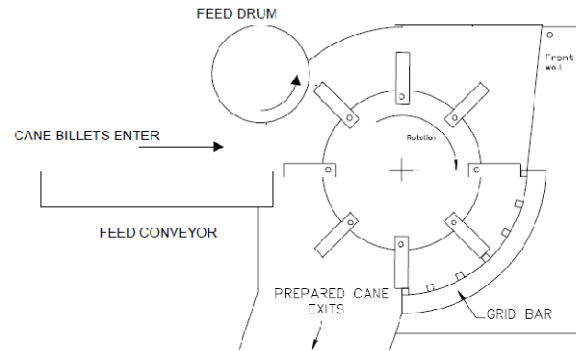


Fig. 2 Schematic diagram of the SRI shredder and the modified feeding system.[3]

Referring to figure 2 the modification of shredder has been done in shredder so that results are changed which is described in table 1.

2.2 Equations

Analysis of work done

Work done in shredder by using modified system where neglecting factors such as bearing friction, windage etc. is made up of two components

1. Work done accelerating cane to the speed of the shredder.
2. Work done across the grid.

$$\text{Energy at centre of mass (E)} = \frac{Mv^2h}{gR} (1 - \cos \theta)$$

Eq. (1)

Where θ represents an angle equivalent to the total work done on the hammer.

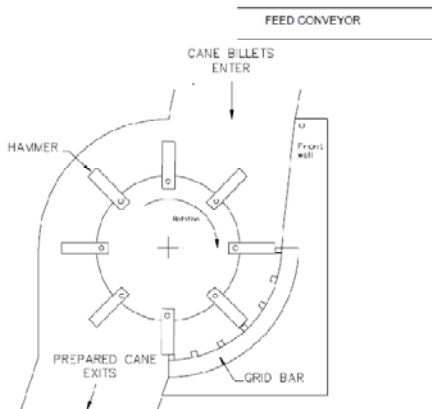


Fig 1 Schematic diagram of the SRI shredder and its original feeding system.[3]

3. Conclusions

In sugar cane industry fibrizer is in main role to cane preparation after the process of leveling of cane. Swing hammer type fibrizer is used in preparation & excellent in operation for in sugar industry. Preparation index is depended on power, grid plates, front wall etc. This is helpful with modification in so that preparation index is increased also it is easy in working, less maintenance, less power consumption & cost reduction machine. So, now a day's swing

hammer type fibrizer is used in all sugar cane industry for better results and high performances.

Appendix

Cane

The material crushed including any trash, dirt, etc.

Preparation

The processing of the cane before crushing usually by rotating chopping devices.

Used also to denote the state of the cane after processing, e.g. fine preparation, degree of preparation.

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