IMPROVING THE FIBER - PITH SEPARARTION OF BAGASSE THROUGH VIBRATING SCREEN – A CASE STUDY

Tonda Saikumar

Shukla Shankarshan

Agarwal Narendra

Abstract

At Yash Papers, both Dry depithing system and Wet depithing system are used for Bagasse fiber - pith separation. Fiber - pith separation is the most important aspect of the process, as pith carryover to the Wet washing system will increase load on ETP and Increase Cooking liquor & Steam consumption in Digestor. This study is directed to improve the fibre - pith separation through Vibrating screen.

This paper contains results & analysis of fibre - pith separation through vibrating screen installed at plant. Encouraging results from lab scale trails has led the decision to install vibrating screen at plant scale.This study was conducted in order to achieve best possible separation of pith and fiber in moist condition. So, we have tried fiber and pith separation through vibrating screen in lab scale.

Introduction

Sugarcane bagasse procured from sugar mills contains 55-60% of ber. The other fraction, rich in pith or parenchymatous tissue (30-35%) contributes to various problems during papermaking like requirement of high cooking chemicals, increased foam, increased costs for handling and storage, inferior quality of pulp, poor black liquor properties and other negative impacts on the environment.

Commercial Depithing equipment has been in use for many years to separate pith from the larger fibres.Bagasse depithing normally occurs in two stages. In the first 'Moist Depithing 'stage, the bagasse passes through the depither in the form it is received from the sugar mills (i.e. 45 %- 55% moisture). The second stage is 'Wet Depithing' whereby a bagasse slurry of 2.5% dry substance is depithed.

Depithers mostly have operational principle as follows; a hammer mill is mounted on a vertical shaft. The rotating assembly is mounted with straight hammers and operates at high speed, typically 1000 – 1800 rpm. The bagasse is fed into the top of the unit (typically) and it is hit by the hammers, opening up clumps of bagasse. The pith is thrown through a screen whilst the longer bast material falls down the centre of the unit to a conveyor. The pith is conveyed away to be burnt in the mill boiler.

Depithing operations are not able to remove the whole pith fraction from the fibers. Equipment and maintenance issues associated with depithing technologies have been reported (e.g. Atchison, 1971a; Paturau, 1989; Diez and Lois, 1989) as well as the efficacy in pith separation (Correa, 1986; Villavicencio, 1971).

Effective Depithing and cleaning is the key for the successful production of quality acceptable pulp and paper from bagasse.

In Conventional Depithing process, pith carryover with Accept fibers to wet washing is still 15-20%.By introducing a vibrating screen for Accept fibers from Depither, we have been successful in reducing carryover of the pith fibers to the wet washing to the extent of 4-5 %.

Materials and methods

Tests were carried out on samples of whole loose bagasse, whole baled bagasse, depithed baled bagasse, depithed loose bagasse and pith to investigate a number of properties. For most of the parameters investigated in this study, standard methods for bagasse do not exist so several existing methods were modified or new methods created so as to produce the data necessary for investigating the Fiber - Pith Separartion of Bagasse through Vibrating Screen.

Depithing Testing Procedure

A. Fiber &Pith Analysis of Bagasse (Manual Screening).

Sampling:

Take the samples ofundepithed bagasse sample, depither no. 1, 2 & 3 accept bagasse sample, composite depithed bagasse sample & compound dust/pith sample.

a) Moisture% determination:

Takes 100 gm of composite sample (A) & put in the Oven, maintain the oven temperature at 105 $\pm$ 2 ^{0}C, after 2 to 3 hours or till constant weight is obtained, weigh the oven dried composite sample (B).

Calculation:

Moisture% =100- (B *100 /A)

b) Fiber Pith Analysis:

Take 50 gm. sample & screening with 13*13 mesh, weigh the fiber (A) & dust/Pith

Calculation:

Fiber % of Bagasse = A*100/50

Pith % of Bagasse = B*100/50

Experimental Work

Lab Trial Procedure & Method

100 g bagasse sample was placed on a vibrating sieve with screen aperture of 1.576 mm. The vibrating motor was turned on with variation in retention time of bagasse on the screen and the bagasse was gently mixed by hand. The pith (defined as being the component of the bagasse that passed through a screen with an aperture of 1.576 mm) passed through the sieve and was collected. The samples were weighed before and after each screening run to determine the proportion of pith separated from the bagasse.

The samples were separated into the following categories:

Whole loose bagasse – running material to depither (undepithed);
Whole baled bagasse – manual shredding of bales (undepithed);

Depithed loose bagasse – with final pith content of 20 %
Depithed baled bagasse – with final pith content of 10 %
Pith – the small particles that pass through the screen.

Experiment design factors:

- Moisture
- Time

Experimental Data of Lab Trial on Vibrating Screen:

As such loose Undepithed bagasse (54 % moisture)																	
Initial		Final after Vibrating screen (Mesh size 13 X 13)															
		Retention time	10 sec			Retention time	15 sec			Retention time	30 sec			Retention time	45 sec		
Moisture %	54	Accept %	79.05	Fibre %	95.09	Accept %	64.2	Fibre %	94.73	Accept %	61.7	Fibre %	97.46	Accept %	57.6	Fibre %	97.36
Fiber %	71.96			Pith %	4.91			Pith %	5.27			Pith %	2.54			Pith %	2.64
Pith %	28.04	Reject %	20.05	Fiber %	31.11	Reject %	35.8	Fiber %	25.92	Reject %	38.3	Fiber %	29.9	Reject %	42.4	Fiber %	36.22
				Pith %	68.39			Pith %	74.07			Pith %	74.07			Pith %	63.77

Depithed loose bagasse (46 % moisture) (Mesh size 13 X 13)																	
Initial		Final after Vibrating screen															
		Retention time	10 sec			Retention time	15 sec			Retention time	30 sec			Retention time	45 sec		
Moisture %	46.8	Accept %	81.7	Fibre %	82.18	Accept %	83.9	Fibre %	89.15	Accept %	72.6	Fibre %	91.15	Accept %	64.9	Fibre %	83.68
Fiber %	74.81			Pith %	17.88			Pith %	10.84			Pith %	8.84			Pith %	16.32
Pith %	25.18	Reject %	18.3	Fiber %	19.35	Reject %	16.1	Fiber %	20.66	Reject %	27.4	Fiber %	27.21	Reject %	35.1	Fiber %	15.94
				Pith %	80.65			Pith %	79.33			Pith %	72.78			Pith %	84.06

Depithed loose bagasse (62 %) (Mesh size 13 X 13)																	
Initial		Final after Vibrating screen															
		Retention time	10 sec			Retention time	15 sec			Retention time	30 sec			Retention time	45 sec		
Moisture %	62	Accept %	73.6	Fibre %	93.44	Accept %	72.55	Fibre %	91.92	Accept %	68.75	Fibre %	94.13	Accept %	62.7	Fibre %	96.73
Fiber %	76.31			Pith %	6.56			Pith %	8.08			Pith %	5.86			Pith %	3.26
Pith %	23.68	Reject %	26.4	Fiber %	28.42	Reject %	27.45	Fiber %	31.31	Reject %	31.25	Fiber %	28.82	Reject %	37.3	Fiber %	28.78
				Pith %	71.57			Pith %	68.69			Pith %	71.18			Pith %	71.21

Wet stored depithed loose bagasse (75.5 % moisture) (Mesh size 13 X 13)																	
Initial		Final after Vibrating screen															
		Retention time	10 sec			Retention time	15 sec			Retention time	30 sec			Retention time	45 sec		
Moisture %	75.5	Accept %	84.4	Fibre %	88.5	Accept %	81.85	Fibre %	88.6	Accept %	85.4	Fibre %	88.83	Accept %	83.65	Fibre %	91
Fiber %	82.04			Pith %	11.5			Pith %	11.4			Pith %	11.17			Pith %	9
Pith %	17.95	Reject %	14.6	Fiber %	41.66	Reject %	18.15	Fiber %	41.17	Reject %	14.6	Fiber %	48.14	Reject %	16.35	Fiber %	40
				Pith %	58.34			Pith %	58.82			Pith %	51.85			Pith %	60

Undepithed baled bagasse after dissintegrater (34.6 % moisture) (Mesh size 13 X 13)																			
Initial		Final after Vibrating screen																	
		Retention time	10 sec			Retention time	15 sec			Retention time	30 sec			Retention time	45 sec				
Moisture %	34.6	Accept %	59.05	Fibre %	92.89	Accept %	53	Fibre %	95.78	Accept %	47	Fibre %	98.72	Accept %	34.2	Fibre %	98.78		
Fiber %	68.04			Pith %	7.1			Pith %	4.22			Pith %	1.28			Pith %	1.22		
Pith %	40.95	Reject %	40.95	Fiber %	23.33	Reject %	47	Fiber %	23.37	Reject %	53	Fiber %	30.7	Reject %	65.8	Fiber %	36.72		
				Pith %	76.67			Pith %	76.62			Pith %	69.3			Pith %	63.28		

Depithed baled bagasse (38.6 % moisture) (Mesh size 13 X 13)																			
Initial		Final after Vibrating screen																	
		Retention time	10 sec			Retention time	15 sec			Retention time	30 sec			Retention time	45 sec				
Moisture %	38.6	Accept %	79.6	Fibre %	98.42	Accept %	79.55	Fibre %	98.44	Accept %	68.4	Fibre %	99.09	Accept %		Fibre %			
Fiber %	90.71			Pith %	1.57			Pith %	1.56			Pith %	0.91			Pith %			
Pith %	9.29	Reject %	20.4	Fiber %	50.8	Reject %	20.45	Fiber %	59.37	Reject %	31.6	Fiber %	56.92	Reject %		Fiber %			
				Pith %	49.2			Pith %	40.63			Pith %	43.07			Pith %			

Design Data of the Vibrating screen for plant scale:

EQUIPMENT	Horizontal Vibratine Screen
DRIVE	Force Geared Exciter
CAPACITY	40 TPH
NO. OF DECK	Triple Deck
SCREEN SIZE	1800 x 4000 mm
MESH MOC	Sprine Steel / Stainless Steel

Result of Horizontal Vibrating Screen for Bagasse Fibre Pith Separation

BAGGASE TYPE	AS SUCH BAGASSE			INLET BAGASSE TO SCREEN			OUTLET OF THE SCREEN			PITH FROM THE SCREEN		
	MOISTURE%	FIBER %	PITH%	MOISTURE%	FIBER %	PITH%	MOISTURE%	FIBER %	PITH%	MOISTURE%	FIBER %	PITH%
LOOSE/MOIST/DEPITHED/TRIAL 1	46	75.5	24.5	47.6	83.9	16.1	42.8	95.4	4.6	51.67	28.5	71.5
LOOSE/MOIST/DEPITHED/TRIAL 2	62.2	71.42	28.8	63.6	78.02	21.97	59.6	88.11	11.89	73.2	10.44	89.56
BALED/HAMMERED/UNDEPITHED/TRIAL 3				33	74.67	25.32	39.8	91.02	8.8	39.3	4.2	95.8

Results and Discussion

1. Fiber pith separation is better by using vibrating screen after depither.
2. The trial 1 data were generated just after commissioning the vibrating screen recently. It was noticed that fiber loss with pith was on higher side due to higher residence time of the material on the screen.
3. This issue was resolved by optimizing the inclination angle & mesh. This has resulted in reduction in fiber loss with the pith.
4. Using vibrating screen decreases the load on Effluent treatment plant from wet washing. And also decrease the consumption of the cooking chemical and steam.
5. Optimization is still going on and we expect better performance in days ahead.
6. We will be able to share more data in near future.

Conclusion

As is evident from the experimental and the field data, use of vibrating screen in combination with depithers can improve fiber quality entering into the digester resulting in expected benefits like reduction in caustic & steam consumption with better pulp properties. Lower pith carryover to wet washing system will also result in load reduction on Effluent treatment plant.

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