Experience in bagasse moist depithing

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ABSTRACT

Successful commercial production of bagasse newsprint and fine quality writing printing paper depends upon the quality of pulp produced. For bagasse pulp, it is necessary to have highly efficient moist depithing & wet depithing systems before it is to be converted into mechanical & chemical pulp. This paper deals with the experience and problem faced during a moist depithing operation in an integrated bagasse based paper/newsprint mill.

INTRODUCTION

While producing chemical pulp and mechanical pulp for the manufacture of newsprint & writing printing paper from bagasse the presence of pith is detrimental to every stage of the process. If the pith is allowed to remain in the bagasse during the pulping or digestion process, it is only natural, because of its completely different physical structure to that of the fibre, that it would be attacked by the chemicals in a different manner. Approximately 30-35% of the B.D. weight of the bagasse consists of pith cells which do not have the character of fibre. It is the presence of pith which results in low opacity, low specific light scattering coefficient and low strength properties when bagasse is converted to mechanical or chemi-mechanical pulp. Therefore, it is essential to remove as much of the pith as possible if acceptable quality of bagasse pulp is to be produced.

Need of Depithing :

When producing high quality pulp & paper from bagasse fibre, separation of a major portion of the pith from the fibre is very necessary before digestion or conversion to other end products, due to the following reasons :—

(a) Pith Cells are undesirable due to their short fibre-length, their greater surface and void volume which pick up dirt and have absorbed sugars, which react with pulping chemical and therefore, increase its consumption.

(b) Pulping of pith cells gives lower pulp yield with higher screen rejects, higher Kappa No. and lower brightness of the pulp.

(c) During cooking process the pith tends to swell after absorption of chemical and becomes gelatinous thus causing difficulties in washing, screening and bleaching by clogging up the wire mesh.

(d) During mechanical pulping the presence of pith cell results in low opacity, low scattering coefficient and low strength bagasse pulp.

(e) Presence of pith cell clogs the paper machine wire & felts thus decreasing drainage rate, sticking to the press rolls, causing frequent paper breaks, decreasing the drying rate of paper and giving shiny paper sports after calendering.

(f) Removal of pith is essential from economic point of view also since pith can be used as fuel.

Therefore, pith must be removed as much as possible before any pulping operation.

Depither Design :

The depither used is similar in design to the Rietz swing hammer depither supplied by Beloit Jones Division. In depither unit, assembly consists of a

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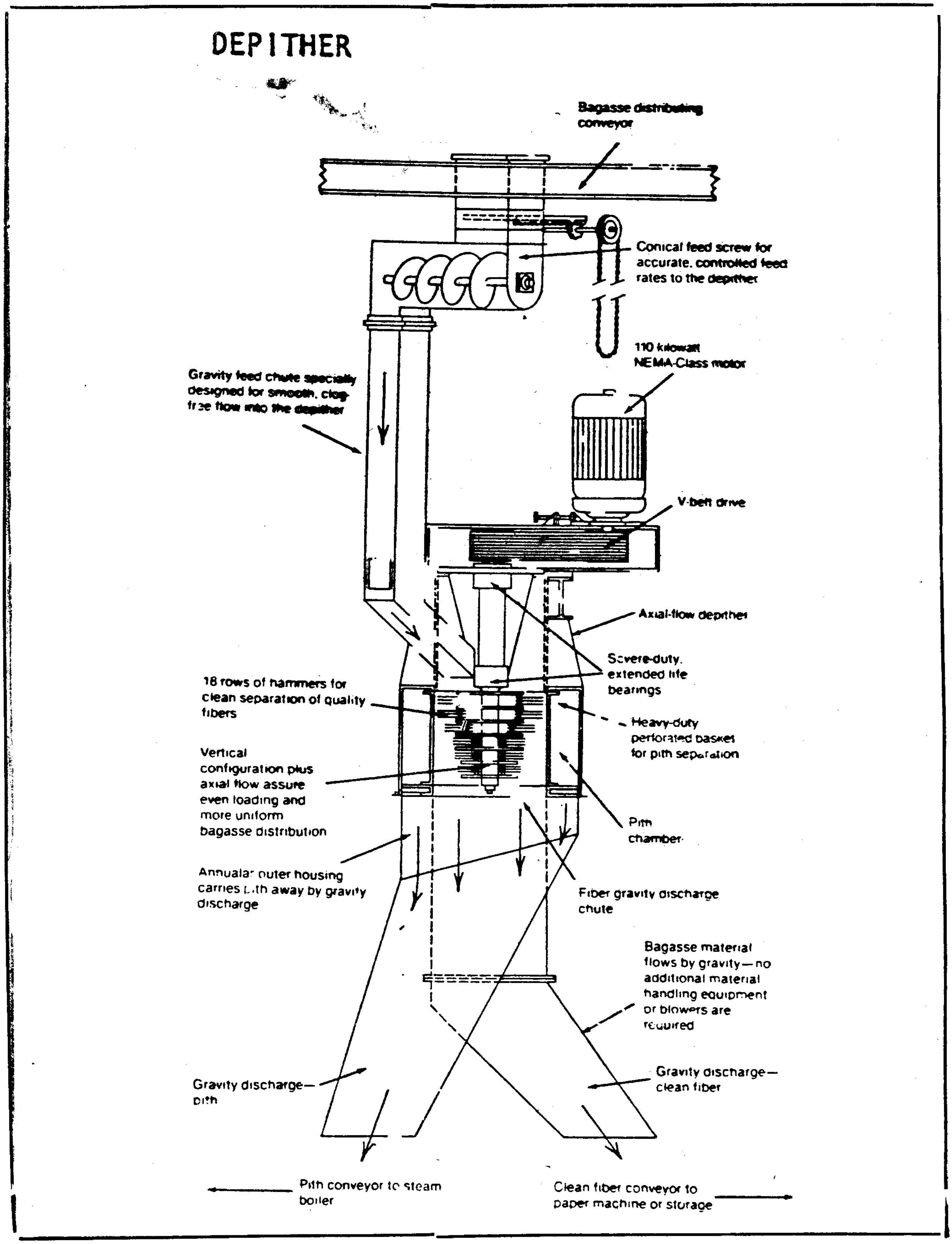
DEPITHER
Bagasse distributing conveyor
Conical feed screw for accurate, controlled feed rates to the depither
110 kilowatt NEMA-Class motor
Gravity feed chute specially designed for smooth, clog-free flow into the depither
V-belt drive
Axial-flow depither
Severe-duty, extended life bearings
18 rows of hammers for clean separation of quality fibers
Heavy-duty perforated basket for pith separation
Vertical configuration plus axial flow assure even loading and more uniform bagasse distribution
Pith chamber
Annualar outer housing carries pith away by gravity discharge
Fiber gravity discharge chute
Bagasse material flows by gravity—no additional material handling equipment or blowers are required
Gravity discharge—pith
Gravity discharge—clean fiber
Pith conveyor to steam boiler
Clean fiber conveyor to paper machine or storage

vertically mounted shaft with a given number of rotor assemblies on its lower end, surrounded by a cylinderical screen. A rotor assembly has six pine between two rotor plates. On each pin there are three knives stacked on the top of each other with spacers in between. The knives have a loose fit on pin. There are 18 rows of hammers for clean separation of fibres. See Annexure—I.

The rotor assemblies are mounted such that each following assembly knives are located 20 degrees counter clockwise off from the one above.

Depither Specifications :

Size	:	KEM—4
Input capacity of each depither	:	16 TPH at 50% moisture
Speed	:	1355 RPM
Max No. of hammers/depither	:	48
Motor	:	110 KW/440 RPM
Basket	:	8mm holes
% age of open area	:	23

Depither Operations and Problems :

The raw bagasse with about 50% Moisture content is received through trucks from the sugar mills in loose and baled form and unloded through tripplers. After break up the baled bagasse passed through radar disc screen to remove stone and other large non fibrous material which might damage the depithers. There are two depithing towers with five depithers in each tower of a capacity of 16 tonnes per hr each. The raw bagasse is fed through a distribution slot conveyor via chute to top of depither which is rotating clockwise The bagasse falling down between the knives is hammered successively by each group of knives. The hammers are free to swing off the way if they meet resistance and this limits, the amount of force which the hammers can exert on the fibres to separate them from pith. The pith by centrifugal force is forced through screen and fibres fall downward by gravity. The system is designed for a capacity of around 150 TPH, bagasse spillage and overflow were experienced during initial period even at the rate of 100 TPH The bagasse distribution slot conveyor failed on several occasions, the chain links were snapping due to over-load. However , after modification of the slot and redesigning of the chutes ensured uniform feed and the performance of the depither optimised. During initial periods the bagasse contained more stones and other foreign materials which damaged the hammers in depither much faster. To avoid stones, to the extent possible the bagasse is being directly collected from the conveyors at sugar mills end.

Trials & Results

To Improve the depithing efficiency several trials were taken. Table No. I indicates the result of the proximate analysis of whole bagasse & depithed bagasse received from different sugar mills.

TABLE — I

Proximate Analysis of Bagasse

S. No.	Particulars	Unit	Mill I (Depithed)	Mill II (Whole)	Mill III (Whole)
1.	Ash	%	2.71	3.09	2.88
2.	Silica	%	1.32	1.72	1.53
3.	Hot water Solubility	%	7.6	5.71	5.84
4.	1% N_aOH solubility	%	35.2	33.70	32.60
5.	A-B Extractives	%	3.34	4.62	3.23
6.	Acid Insoluble	%	18.7	18.9	19.2
7.	Holo cellulose	%	66.4	65.10	65.50
8.	Pentosans	%	25.4	24.4	24.6

Note:— All results are expressed on O. D. unextracted basis.

Table II-A

Fibre Pith Analysis During Normal Depithing Condition

Particulars	Unit	Whole Bagasse	Depithed Bagasse	Pith
Useful Fibre	%	53.7	61.1	20.1
Pith	%	33.1	27.4	66.7
Water soluble	%	13.2	11.5	13.2
Fiber Pith Ratio	%	1.79:1	2.30:1	0.30:1

Basket Perforatiou — 8 m m with opening area 23%

TABLE-IIB

FIBRE PITH ANALYSIS

Particulars	Unit	Whole	Depithed Bagasse Metering Screw Speed RPM				Pith
			AT 700	AT 800	AT 900	AT 1000	
Useful Fiber	%	52.2	60.2	58.7	58.4	59.2	19 6
Pith	%	34.5	27.4	29.5	28.5	31.5	61.4
Water Solubles	%	13.3	12.4	11.8	13.1	9 3	10 0
Fibre Pith Ratio	%	1.60:1	2.20:1	1.99:I	2.05:1	1.88:1	0 32:1

Depither : DP-2 which was arranged with dynodrive for metering screw. Motor RPM-1440, gear box ratio 1:30. Basket perforation - 8 mm with opening area of 23%.

TABLE—III

FIBRE PITH ANALYSIS

Particulars	Unit	Whole Bagasse	Depithed Bagasse			Pith		
			DP-6	DP-5	DP-3	DP-6	DP-5	DP-3
Useful Fibre	%	51.4	64.6	65.5	62.6	15.8	22.3	14.9
Pith	%	35.5	27.8	27.1	30.1	76.7	70.4	76.3
Water Solubles	%	13.1	7.6	7.4	7.3	7.5	7.3	9.1
Fibre Pith Ratio	%	1.50:1	2.36:1	2.45:1	2.15:1	0.21:1	0.32:1	0.20:1

Depither : No. 6 with 48 hammers and 8 mm dia perforation basket with 23 mm pitch.
No. 5 with 60 hammers and 7 mm dia perforation basket with 23 mm pitch.
No. 3 with 48 hammers and 7 mm dia perforation basket with 23 mm pitch.
(Opening Area - 23%)

Table No. II-A&B-indicates the fibre pith analysis result after regulating the flow rate of bagasse by dyno drive system from metering screw arrangement. It shows that useful fibre fraction is slightly higher at 700 rpm while the fibre pith ratio of depithed bagasse during normal run and trial had not much difference.

It can be seen from Table No. III that the useful fibre fraction is increasing by increasing the number of hammers. Fibre fraction is also changing by changing the screen plate hole size But during the trial run result showed that difference is not appreciable due to non-uniform feeding and fibre pith ratio in pith also varies from 0.20 to 0.32 : 1. It can be seen from the Table No. IV that the fibre pith ratio increases up to 3.5 : 1 by increasing the open area in the screen plate from 23% to 33.4% at the same 8 mm hole size while the fibre pith ratio in pith is not having any difference. By increasing the open area further from 33.4% to 42% with same 8mm hole size, it can be seen from Table No. V that useful fibre pith ratio increased but not having significant difference in depithed bagassed quality.

TABLE—IV

FIBRE - PITH ANALYSIS

Particulars	Unit	Whole Bagasse	Depithed Bagasse DP-3	DP-5	Pith DP-3	DP-5
Useful Fibre	%	55.2	70.2	66.8	22.8	23.5
Pith	%	34.5	20.0	26.6	69.7	68 6
Water Solubles	%	10.3	9.8	6.6	7.5	7.9
Fibre Pith Ratio	%	1.60:1	3.51:1	2.51:1	0.33:1	0.34.1
Moisture	%	47.6	47.0	47.9	46.5	46.4

Depither : No. 3 with 48 hammers and 8 mm basket (moaified) 19 mm pitch.
No. 5 with 48 hammers and 8 mm basket 23 mm pitch.
(Opening Area - 33.4%)

TABLE—V

FIBRE - PITH ANALYSIS

Particulars	Unit	Whole Bagasse	Depithed Bagasse DP-3	DP-6	Pith DP-3	DP-6
Useful Fibre	%	53.8	68.4	66.3	16.8	
Pith	%	32.7	23.3	24.9	73 3	
Water Solubles	%	13.5	8.3	8.8	9.9	
Fibre Pith Ratio	%	1.55:1	2.93:1	2.66:1	0.23:1	
Moisture	%	54.8	54.8	54.8	58.0	

Depither : No. 3 with 48 hammers and 8 mm basket (modified) 17 mm pitch.
No. 6 with 48 hammers and 8 mm basket 19 mm pitch.
(Open Area - 42%)

Conclusion

It is obvious from the fore going that the production of high quality pulp and paper from bagasse fibre, efficient depithing is very important. Therefore, if bagasse is depithed at optimum condition and stored properly, a brighter , stronger and more opaque pulp can be produced which is suitable for pulp and paper/newsprint making.

It is also known that the pith either refined has the lowest specific scattering coefficient, so undepithed bagasse has a lower specific scattering coefficient than that of the depithed bagasse.

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