Dry Type Bagasse Depithing Plant at Shri Datta Shetkari Sahakari Sakhar Karkhana Ltd. Shirol

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ABSTRACT

Shree Datta ShatKari Sahakari Sakhar Karkhana Ltd. P. O Shirol, Tal : Jaisinghpur Dist. : Kolhapur has installed a 20 TPD capacity integrated paper and pulp mill. Dry type bagasse depithing plant has been installed by the mill. The mill is in operation for about 2 years now. The bagasse depithing plant incorporates large quantity material handling equipment both for bagasse handling as well as processing An attempt is made here by the authors to present case study observations and recommendation for such plants in future.

Shree Datta Shetkari Sahakari Sakhar Karkhana Ltd. uses 75% to 85% depithed bagasse as raw material and has been able to produce 22 T. W & P Paper in a single day (more than 15% of rated capacity). Following sections throw light on the field observations and records of depithing plant.

DESCRIPTION OF THE PLANT :

The depithing plant consists of equipment like belt conveyors, hammer depither, screens, screw conveyors, elevators etc. and the flow of material is as per fig. 1. The plant is designed to produce 4 TPH depithed bagasse at theoretical moisture content of 35% by weight. While belt conveyors, screw conveyors and the elevators are bulk material handling equipment, the bale breaker (fig. 2) the Hammer Mill (fig. 3) and the set of screens (fig 4) are the equipment in which process of depithing is carried out. Action of individual equipment is described below :

1) Flat belt conveyor (item (1) of Fig. 1) is meant to carry the bagasse bales (after dewiring) to the bale breaker (item (2 of fig. 2)

2) Top two rolls of bale breaker, by scraping action reduce the bale to small slices while the lower two rolls due to differential speeds reduce the sizes of slices upto max. of 100 mm. At the same time, the lower rolls also loosen up the pith particles.

3) The broken bagasse is taken to elevator (ite (3) of fig. (1) which elevates the bagasse and feeds the depither)hammer mill (item (4) of fig. (1 . Thus the elevator is an aid to elevate the bagasse. It does not perform any processing action on the broken bagasse.

4) The Hammer Mill (depither) is the machine where the bagasse is subjected to thrasting and hard brushing action by virtue of which the pith particles are separated from the bagasse fibre. Since the thrashing action is due to hammers, certain amount of damage to fibres cannot be avoided. However the permanent layer of bagasse between the cage bar assembly and the hammer circle does not crush the fibres of bagasse.

5) The mixture of bagasse and pith is then fed to a screw feeder (item (5) of fig. 1) which feeds the elevator in positive manner. (Item (6) fig 1) which in turn feeds the vibratory screens (item (7) a & (7) b of fig. 1). The screens have two decks. Top deck acts as buffer deck. This deck has 20×20 Square opening. Lower deck has 24/26 guage screening cloth for first 1 metre length and 13/16 guage screening cloth for whole of balance length.

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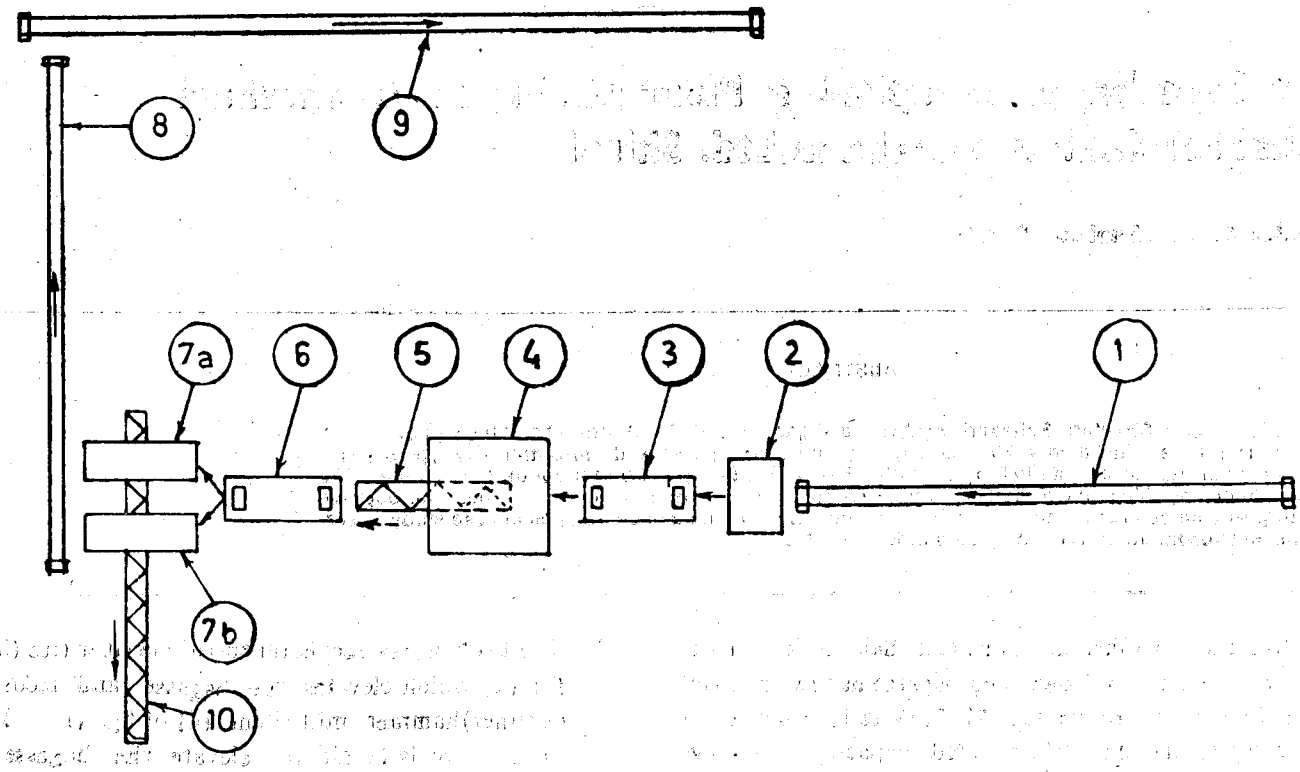
FIG. 1



1) BELT CARRYING CONVEYOR
2) BALE BREAKER
3) ELEVATOR
4) HAMMER MILL
5) SCREW FEEDER
6) ELEVATOR
7a) V SCREEN
7b) V SCREEN
8) ACCEPTABLE BAGASSE CONVEYOR
9) DIGESTOR LOADING CONVEYOR
10) PITH SCREW CONVEYOR

FIG. 2

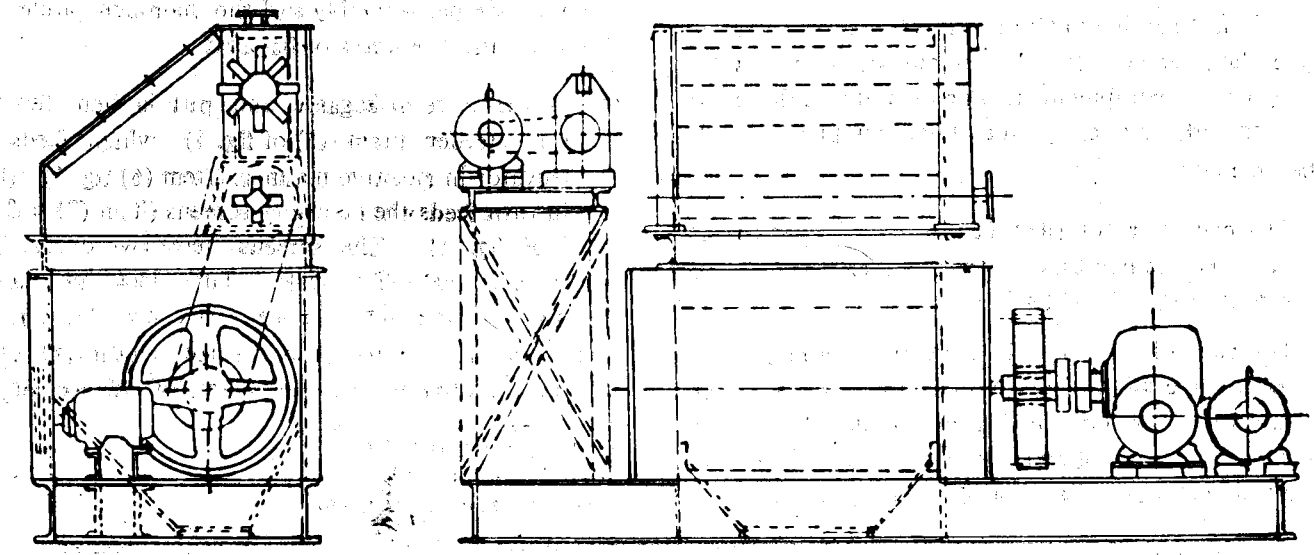


Fig.—3

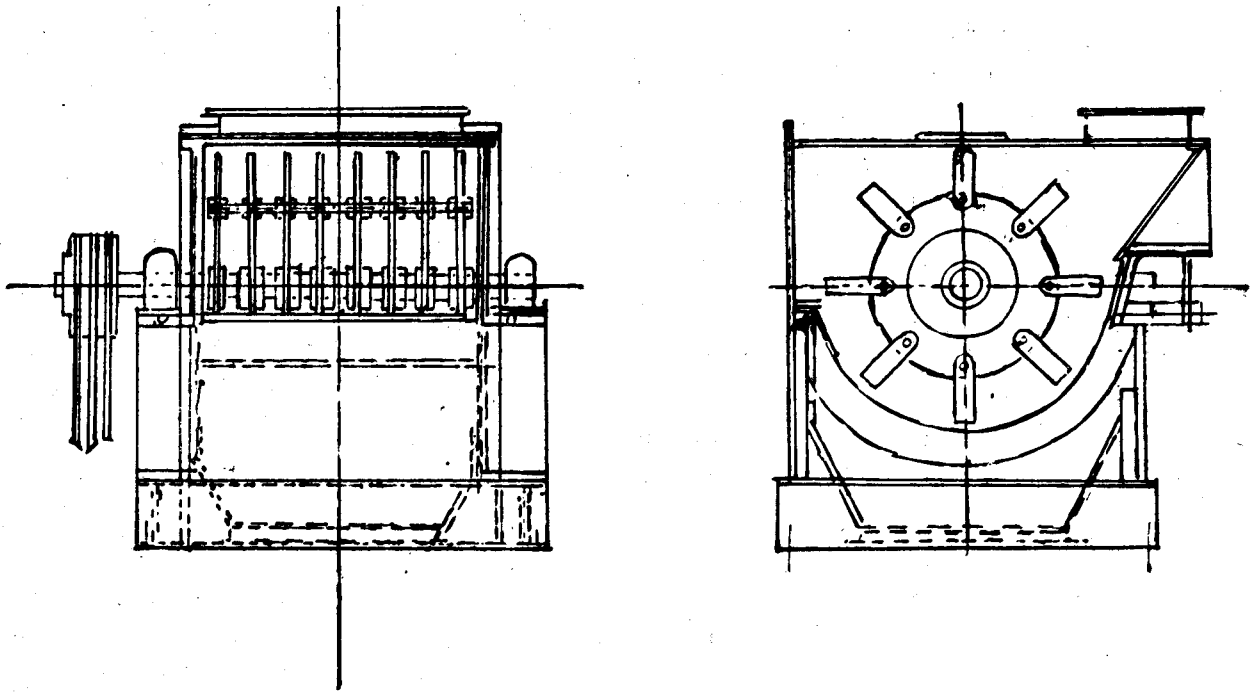
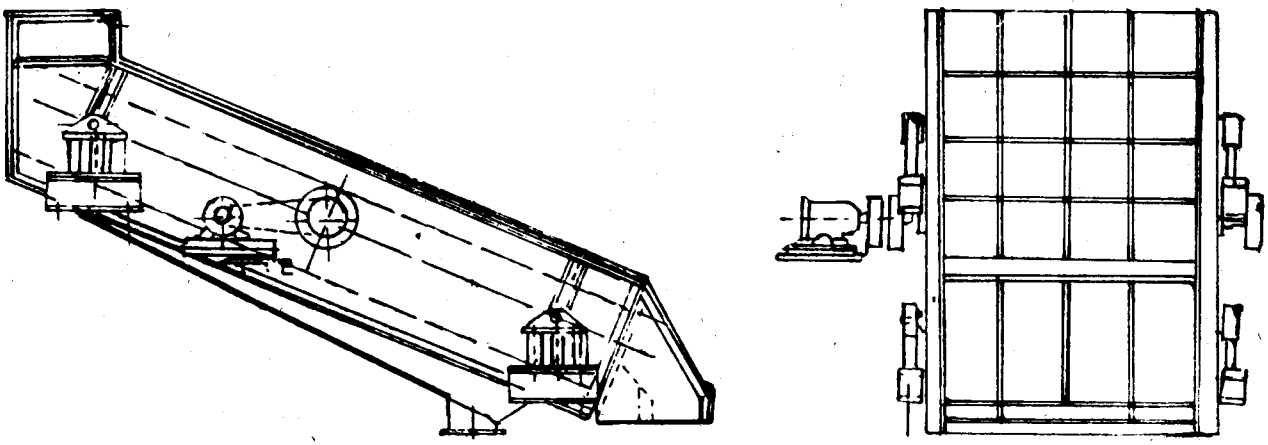


Fig.—4



It is this deck which separates out the pith from bagasse physically.

6) Belt conveyors (item (8) & (9) of fig. 1) carry and distribute the bagasse in the digestors while screw conveyor item ((10) of fig. 1) collects the pith and discharges the same outside the dipithing house area.

PERFORMANCE OBSERVATIONS :

A) Non process equipment :

The plant is in operation for more than two years. During this period following performance aspects were noted.

A.1. Belt conveyors carried whole bales as well as loose

bagasse in a satisfactory manner. Rated output was always available.

A 2. Components of belt conveyors like idlers, pulleys, scrapers etc. did not need replacement.

A 3. Drive powers provided were found adequate. Even when the belts were loaded beyond rated capacities no problems were encountered.

A 4. Even when rain soaked bagasse was put into stream the conveyor slopes of 17° were found satisfactory. No slide back of bales/bulk bagasse was observed.

A 5. Screw conveyor item (5) of fig. 1, jammed up quite often in the beginning. Subsequently the drive power was increased to 1.5 times initial value. This eliminated the problem of jamming

A 6. When moisture content in bagasse was high, (when rain bagasse was in stream) jamming of item (5) of fig. 1 was of higher order.

A 7. When bagasse moisture was between 15%to 20% no jamming of screw conveyors occured with increased power.

A 8. Elevator boot section has tendency of bagasse accumulation, compaction and jamming up.

A 9. Elevator boot jamming was frequent if free moisture in bagasse was in excess 40% (e g. rain soaked bagasse in stream)

A10. Though capacity wise elevators did not pose problems, over all mechanical break-downs were of higher order. This was especially true in the case of elevator chains.

B) Process Equipment :

B 1. Bale breaker was capable of operating with rain soaked bagasse feed, mill wet bagasse feed etc. effortlessly.

B 2. No mechanical problems were encountered.

B 3. Dust generated during bale breaking operation (when bagasse was dry) was higher compared to bagasse with higher moisture content i e. in excess of 30%.

B 4. Hammer Mill has not posed any operational problems Hammer hard facing was very frequently done.

B 5. when hammer wear out was uneven, the quality of bagasse on output side was different.

B 6. Every fortnight, the hammers were checked for wear out and built-up if required.

B 7. Due to over feeding, the mill choked up very fast and removal of choked material was very difficult Least time recorded to remove the choking from system was 120 minutes.

B 8. The oil lubricated bearings for the mill needed lubrication refill every alternate day.

B 9. Only once bearing seizure of mill was recorded during entire operation.

B 10. The screens performed well with G.I wire cloths.

B 11. When the lst 1.M. length of 24/26 mesh cloth was removed the pith removal efficiency decreased Loss of fibre was visual

B 12. The bottom vibrating pan in which the pith is collected frequently cracked After strengthening the frequency went down.

B 13. Dust nuisance was highest compared to all areas in the screening area.

B 14. Screen bearings are oil lubricated. Same care was taken as in B. 8.

B 15. Life of G.I. wire cloth was not more than 30 days.

C) Entire System in full Circuit :

C 1, For 40m³ digestor, absolute total loading time recorded as lowest was 90 minutes at a moisture content of 20%.

C 2. Bagasse removed as pith varied as per moisture content, decay in bagasse bale etc. but on the whole 16% to 20% removal was recorded.

C. 3. Total connected power for entire depithing plant is 115 9 K.W. The average consumed power is 75 KW hr/hour.

C 4. Careful and sustained loading on item (l) of fig 1 drastically decreased the choking and jamming problems. As a matter of fact reduced to near zero.

C.5. Sometimes wires which are used to tie the bales went through the system. No harm was done to the plant No attempts however were made to assess additional wear of mill hammers due to such phenomina.

C.6. Table 1 gives log of depithing plant on a particular day. Table 2 gives analysis of bagasse pith and depithed bagasse on a particular day.

Table 3 gives chemical details on a particular day when 85% depithed bagasse was used to produce 45-58 grammage w & p paper.

Table 4 gives details of spares, replacements provided to the plant till date.

TABLE NO. 1

i)	Running hours.	—	12 hrs. 5 mts.
ii)	Shut hours.	—	11 hrs. 55 mts.
iii)	Reasons for shut hours	—	Want of Empty digestor and belt repair.
iv)	Depithed bagasse produced.	—	33600 kg.
v)	Pith quantity produced.	—	6400 Kg.
vi)	Moisture content.	—	20% Max. 18% Min.
vii)	No. of digestors loaded.	—	Seven.

TABLE NO. 2

Analysis of Depithed Bagasse And Pith

		Depithed bagasse.	Pith.
(A)	**By Wet Method :**		
A. 1.	%retained on 20 mesh.	82	50
A. 2.	%through 20 mesh retained on Nylon.	13	36
A. 3.	Difference.	5	14
(B)	**By dry sieving Method :**		
B. 1.	%+ 20 mesh.	83.2	28.4
B. 2.	%— 20 to + 36 mesh.	7.5	13.7
B 3.	%— 36 to + 60 mesh.	5.8	33.3
B 4.	%— 60 mesh.	3.5	24.6

TABLE NO. 3

(A)	**Digestor House :**		
A 1.	Digestors blown.	—	9 Nos.
A. 2.	Unbleached pulp produced	—	18 MT.
A 3.	Caustic lye used in digestor	—	14 6% with catalyst D.
(B)	**Bleaching Section :**		
B 1.	%Chlorine used.	—	10.1%
B. 2.	Bleached pulp produced	—	16 2 MT.
B. 3.	Bleached pulp supply to stock prep.	—	17.3 M.T.
B. 4.	B.L. free Alkali.	—	2.8, 1.52, 1.4
B. 5.	K Nos.	—	11.1, 12.7, 14 2, 14.3, 13.0, 12.0
B 6.	Lime GPL.	—	36.4, 30.8, 30.8
B. 7.	Hypo GPL.	—	23 25, 23 61, 24.85
B. 8.	Residual Cl_2	—	213, 177.5, 177.5, 228, 213.

TABLE NO. 4

No.	Description of Replacement	Reason.	Aprox. Cost. in Rs.
(1)	Belt changed.	Damage due to bad use.	15000/-
(2)	Gearbox worm shaft changed.	Damaged.	2500/-
(3)	Elevator chain replaced.	Out of shape & elongation.	30000/-
(4)	Buckets (30 Nos) changed.	Damage due to main chain break.	3000/-
(5)	Hammer Mill bearing replaced.	Siezure due to lack of lubricant	3000/-
(6)	Screw conveyor motor replaced.	Original motor under capacity.	2000/-
(7)	Vibrating Screen bearings replaced.	Service life over.	12000/-
(8)	Vibrating Screen lining & gaskets changed 4 times.	maintenance.	2400/-
(9)	Screw Conveyor drive chain and sprockets replaced.	Wear out of sprockets.	1000/-

CONCLUSIONS AND OBSERVATIONS :

1) Dry type depithing Plant is satisfactory for paper mill of this type.

2) Preventive maintenance and careful loading are a must for continuous and satisfactory performance for this type of plant.

3) Preferably only belt conveyors should be used in place of elevators, in order to reduce maintenance problems.

4) If this type of plant is to be used for batch type pulping plants, intermediate storage of depithed bagasse will be an added facility.

5) Bagasse with 15 to 20 moisture content (i.e. between 1.5 to 2 months air dried) should be used for optimum results.

6) Chute slopes less than 60° should not be used. There shall not be any welding inside the chutes. If chutes of material like formica/sunmica are provided self cleansing will be better.

7) Dust suppression system should be provided in depithing house area to control dust hazard.

8) If any equipment to increase density of bagasse before feeding the digestor is added, it will be an added advantage as loading time can be reduced.

9) Magnetic separator should be provided before hammer mill to remove stray wire pieces.

10) Screw conveyors/feeders (except for pith carrying) can be eliminated by providing chutes with smooth insides and if possible altering positions of equal.

11) For all such future plants followings should be noted.

   a. Elevators and Screw feeders should be avoided.

   b. Packing density of bagasse shall be increased before digestor feed.

   c. For batch type pulping units, intermediate storage and add back to stream facility of depithed bagasse may be thought of.

   d. No skew transfer of bagasse should be planned.

   e. All chutes may be with very smooth inside surfaces.

   f. Conveyor slopes upto 17° can be provided.

   g. Stainless steel wire cloth panels shall be thought of and used for bottom deck of screens.

   h. Possibility of using one screen with single deck only can be thought of.

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