Our Experiences on the Role of Precooking Operations in the Manufacture of Paper Grade Market Pulp.

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Market grade pulp mills have to maintain high standards of pulp quality with respect to brightness, brightness stability and strength properties. The experiences gained at the Central Pulp Mills Ltd. in achieving the above objectives have been outlined in this article.

Mainly, the effect of chips quality has been discussed in more detail and it is evident that a good chipper plant giving the required quality of the chips is essential for an efficient pulping operation. The effects of chips size, chips washing, loading procedure have been pointed out. This also helps in achieving a good quality production at higher Kappa Nos, where recovery plant capacities are the bottlenecks. A brief description of the plant at 'Cenpulp' is also given.

Introduction

At present the Central Pulp Mills Ltd., is the only mill producing paper grade market pulp in India having about 100 T/day production capacity. A part of pulp is now converted into Paper.

Brief Description of the Plant

The 'CENPULP' has 4 No. of bamboo chippers of PAPCO' make with horizontal forced feeding arrangement with a chips washing system. Chips are pneumatically conveyed to a storage Silo having table feeder arrangement with a belt conveyor. Cooking section consists of 4 Nos. of 95 M^3 vertical direct steaming stationary digesters. The Bird deknotter and screen rejects are mixed with black liquor and charged to digesters as makeup. Washing Plant consists of two stage washing having displacement type washers, each having 350 sq. ft. surface area. The screening section consists of 3 screening stages with two Cowan centrifugal screens and 1 Bird vibrating screen followed by 3 stage centricleaning system having 7" Bird centri cleaners. The bleaching plant consists of a Standard CEHH sequence having a Kamyr chlorine mixer with a disperser and all upward flow towers having HD pumps. The bleach washers are of 300 ft^2 surface area each.

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Flash dryer :

3 stage D and S flash drying system is employed where the pulp is dried in stage and subsequently cooled in 3rd stage before being compressed in slab form having moisture in pulp between 22–24% for baling. The drying system consists of a fan, tower and a cyclone in each stage. Cenpulp flash drying system details have already been published, (Ref. 1)

Discusion on Cooking Properties

The cooking section of any mill is very important for controlling proper quality and achieving higher pulp yields for better raw material conservation.

The purpose of this discussion is to highlight the effect of some of the digester variables affecting quality, yield and the quantity of production from an economic point of view, as experienced at 'Cenpulp' on plant scale. No. attempt is made here to highlight the effect of sulphidity, alkali requirement, bath ratio, etc. which are widely known. Particular stress is mainly given on the digester variables.

Effect of Chip Quality

The quality of chips loaded at digesters is given in Table 1.

Most of the bamboo chipped is *"Dendrocalamus strictus"* The chip washing system removes the adhering silica and some of the internal silica. The silica content removed in washing is around 0.3 to 0.5%; out of the original 2.5% in bamboo before washing. The moisture content of the chips after washing is around 30–35%. Each mill is generally interested in getting maximum pulp per cook without affecting quality. This is important for getting more production and less steam consumption.

Effect of Chip Size, Dust, Slivers on Digester Loading :

The dust and slivers play an important role in the loading of digesters. The presence of dust or slivers reduces digester loading. So, the important variable to be controlled is the acceptable chip size percentage (—28 to +4 mm on Williams chips classifier). When the chips accepts varied from 88% to 95%. the pulp (B.D unbleached) per digester increased from 9.4 to 10.5 tons indicating the effect on yield and digester loading. It is evident from Table 2 that the loading of chips in the digester increased from 19 tons to 22 tons BD with a simultaneous increase in the yield by about 2.5%.

Over size Chips And Slivers :

It was observed that when over-size chips or slivers increased by about 8—10% in chips (+28 mm fraction), permanganate number was reduced by about 1 to 1.5. However, in order to control the rejects at deknotter it was necessary to add more alkali which affected both pulp yield and quality (heterogeneous pulp).

Dust :

The increase in undersize (-4 mm fraction) percentage by about 5—10%, increased permanganate number by about 1.5 to 2, reducing the yield by about 1 to 1.5. The undersize is likely to get overcooked leaving less alkali for rest of the normal chips. If the dust is dry, the digester loading goes down and also it creates operational problem by choaking the venting strainers. So it is advisable to remove the dust in the chipper house by screening and further by washing.

TABLE 1 (A)

A typical chip classification (Williums)

		Before screening %		After screening %		After washing %	
+28	mm	8.7		5.2		4.0	
−28+21	mm	12.3		13.1		8.6	
−21+16	mm	25.5		28.4		26.6	
−16+7	mm	33.8	86.0%	34.9	90.8%	39.6	92.5%
−7 +4	mm	14.4	accepts	14.2	accepts	17.7	accepts.
−4	mm	5.3		4.0		3.5	

TABLE 1 (B)

Chip Size (average)

	Length mm	Width mm	Thickness mm
+ 28 mm fraction	57	24	12
— 4 mm fraction	3.6	0.6	0.4
Accepts	22.6	10.4	4.3
Cutting angle : 75–80°			

Table 2

Sr. No.	BD Chips loaded Tons.	Yield/Digester Tons	Chips Accepts %
1.	20—22.5	10.5	93—95
2.	19 - 21	9.4	88—90

The increase in dust or slivers in chips is also likely to increase the reblows. The better chips quality at Cenpulp is quite evident from deknotter size (72" L x 39" W, 15 ft^2 area) which is able to handle 150 T of production/day.

At 22 permanganate number the deknotter rejects are around 1% and screen rejects around 2%. The rejects are recycled to the digester.

Effect of Chip Geometry :

Chip geometry plays an important role on pulp quality (Ref 2). Our experience confirms the above observations. In any pulping process, the disadvantages of poor quality chips are outlined below :

1. Less than the maximum utilisation of fibers.
2. Non uniformity in process operations.
3. Loss in pulp yield and quality.
4. Production of off grade pulp and increase in production cost.

The paper states the specific effect of chips grain length and thickness on pulp yield, pulp quality, screen rejects, permanganate number and effective alkali consumption in kraft cooking.

As given in Fig 1, at a constant permanganate number of 20, an optimum yield can be achieved around a grain length of around 1". Still better results are possible as the chips become thinner in terms of maximum screened pulp yield at minimum rejects.

Effect of Chip Washing

Normally the washed chips contain 30%—33% moisture. In case of bamboo containing very high moisture (green bamboo), chip moisture may go up to 37%—38%. The effect of moisture content in chips at the time of loading is given in Table 3. It is evident from the table that when the moisture varied between 30% to 32% the loading in digester increased resulting in more pulp/digester and giving uniform cooking with less rejects. Furthermore, chip washing reduces the dust, silica and adhering dirt from the chips. However, when the moisture content in chips is above 40%, it results in a pulp of higher

Table 3

Sr. No.	Moisture in chips (%)	BD chips loaded in Digester (tons)
1.	20 — 25	19 — 20
2.	27 — 32	20 — 22
3.	30 — 35	22 — 24
4.	Above 40	20 — 22

Note : The various moisture % were obtained by mixing dry chips with washed chips.

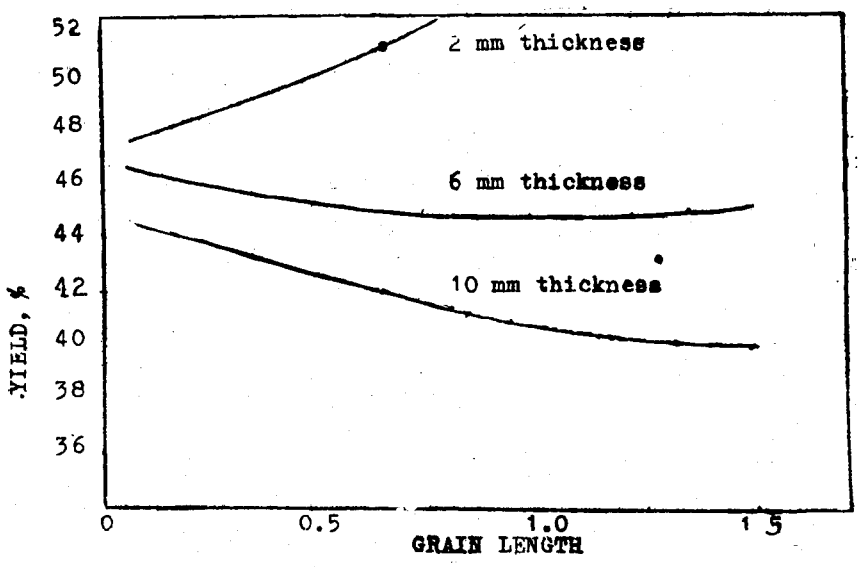

Figure 1—INCHES

permanganate number at a higher percentage of rejects.

Digester Loading Procedures

The loading of digester is an important process variable. 'Cenpulp' digesters are of 95 m^3 with direct steaming and with a charging line separate from digester for charging through the lid opening. It was observed that when loading was increased, pulp obtained per digester increased from 9.5 tons to 11.5 tons (BD unbleached) and the steam consumption dropped from 1.5 to 1.2 tons per ton of pulp and the yield rise was by about 1% to 2%.

The loading of digester is very important to the mills having low digester capacity, in comparison to other plant facilities. Some of the factors affecting the loading were discussed above. Apart from that, loading can greatly be increased by circulation of liquor and reloading, which is practised by some of the mills. In our observation, the first loading time has been found to affect the loading of digester greatly. When the loading time increased from 30 minutes to 60 minutes, loading of digesters dropped by about 2 tons. Taking some amount of liquor before loading has been found to increase the packing density in digester. Mills having indirect steaming digesters will have more advantages in achieving better loading, as no space is required for steam condensation.

Cooking Conditions:—

Mostly standard cooking conditions are followed. Conditions are given in Table 4. Impregnation of chips with white liqour in initial stages is very important for uniform cooking. This is achieved by initial slow steaming with continuous circulation of liquor throughout the cooking.

Table 4

Approx. chip loaded	:	22.5 tons BD	Steaming time to max. temp.	:	3 hrs.
Chemicals charged	:	16% on BD chips (TAA as Na_2O)	Time at max. temp.	:	1 to 1½ hrs.
Bath ratio (Before steaming)	:	2.5 to 2.6			
Pulp/Digester	:	11 tons (BD unbleached)	Max. temp.	:	155/160°C
Approx yield	:	49%			

Permanganate Number & Bleaching

Market grade pulp requires good pulp strength, brightness and brightness stability. 'Cenpulp' has the standard 4 stage conventional CEHH bleaching sequence, and so it is able to bleach pulp having P.No. (22±1) maintaining the quality standards. This is possible because firstly we have a very good Kamyer Cl_2 mixer, requiring only 15 minute retention time in the tower for complete chlorination and a subsequent good extraction (with around 4% NaOH at 60°C), which brings down the extracted P.No. to 6 to 6.5. Secondly pulp having very less rejects helps in clean final pulp having 80/81 PV brightness (Pc value 6–7) and good strength properties. Due to limitation in our recovery plant capacity, high P.No. pulp processing is done in our mills to maintain the higher production levels. The increase in production obtained is around 15% to 20% when the P.Nos. are raised from 17 to 22 without sacrificing pulp quality.

Conclusions

For getting uniform quality pulp with minimum rejects at higher yields, 'Cenpulp's experience indicates the following points :

1. Accepted chips size (—28 mm to +4 mm) fraction should be around 90% or above.
2. Chips length in the range 3/4" to 1" has been found to give very uniform pulp with minimum rejects (even at higher permanganate number).
3. Washed chips having around 30–35% moisture increases digester loading, giving more pulp per digester and helps in better cooking liquor penetration in chips.
4. Steam consumption can be brought down by a significant amount by increasing the chip loading in the digester.

5. A uniform cooking in digester with minimum rejects makes it possible to bleach a high permangnate number pulp (22 P.No.) to result in a market pulp of higher brightness and strength properties. However, a good bleaching system with better chlorination and extraction is essential.

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