Economic Utilization of Bagasse

Arunachalam S.*, Raghavan S.*
Swaminathan N.*, Gopalaswami K.*

The Indian Pulp & Paper Industry is steadily growing and has attained an installed capacity of more than two million tonnes. The demand for paper by 2000 A.D. is expected to exeeed four million tonnes. Shortage of forest based raw materials is one of the acute problems affecting the growth of the paper industry today. Assuming the projected demand, it is estimated that by 2000 A.D. the raw material requirement for production of paper will be about 68 lakh tonnes/annum and there will be a shortage of 40 lakh tonnes. In this context; utilization of agricultural waste like straw, bagasse etc, has gained tremendous impetus. This paper is intended mainly to indicate certain technical and economic aspects related to the use of bagasse in making pulp and paper.

Bagasse, which is the residue after crushing of sugarcane is an abundantly available source for expanding paper production. In order to encourage increased use of bagasse, the Government of India announced in April 1979, total exemption from excise duty for paper containing 75% or more bagasse pulp and 50% exemption for paper containing 50% bagasse pulp. This has resulted in the utilization of bagasse for production of pulp and paper on a much larger scale than hitherto.

Bagasse has three main constituents :—

(a) The fibrovascular bundles—containing rather short fibres.

(b) The rind fibres—Containing longer fibres.

(c) The pith or parenchyma cells—Non fibrous structure, amounting to almost 30%.

Non fibrous cellular structure of pith makes it unsuitable for paper making and its presence in pulp creates serious draw back in producing good quality paper. Non removal of pith will result in higher consumption of chemicals for cooking and bleaching. Pith has a tendency to swell and become gelatinous, a condition which helps in the retention of impurities. The gelatinous condition caused to the pith during cooking hinders filtration and washing of pulp. The pulp is very slow in drainage and causes wire chocking, accumulation over flat boxes, presspicking and coating of dryer and suction felts. The surface of pith is greater than the fibre in bagasse and the pith will pick up and hold large amount of dirt and grit. Due to non-fibrous and absorbent nature of pith the impurities so deeply lodged cannot be removed by severe chemical treatment. The presence of dirt and extraneous matter will require excess of bleach and even then the desired degree of brightness cannot be attained. The resultant paper is weak and marked with higher dirt content and specks due to presence of incompletely bleached particles of pith.

Hence, it is clear that proper fibre preparation—depithing of bagasse before digestion will have great effect on the chemical consumption, the cleanliness, the yield and quality of pulp. The key to successful use of bagasse lies in an efficient and effective commercial means of removing the pith from bagasse followed by economic use of the pith.

Considerable efforts have been made in recent years in developing efficient depithing methods. The depithing method generally falls into three categories.

1. Dry depithing method involving separation of pith from Bagasse which has become dry after storage.

2. Moist or humid depithing method of mill bagasse at approximately 50% moisture as it comes from the sugar mill.

*Chellam Marketing and Consultancy Pvt. Ltd.
132, Usman Road, T. Nagar. MADRAS-600 017.

3. Wet method of depithing which is carried out in dilute suspension of bagasse of about 2% consistency.

For a long time pith removal was carried out only by a dry depithing operation at the pulp mill. By this method only about one half of the pith was removed resulting in poor depithed fibre and associated pulping problems.

One of the reasons for failure of carlier attempts at the use of bagasse for paper making is non-removal of pith by proper methods. In dry depithing, fibre loss along with pith will be more and lot of dust is produced leading to atmospheric pollution affecting the health of operating personnel.

For better results in depithing, a combination of the two methods has proved to be more effective. From the economical point of view, it is advantageous to remove as much of the pith as possible at the sugar mill when the bagasse is moist. With the system detailed later in this paper, it is possible to remove about 50% of the total pith content in bagasse in the sugar mill. The pith so removed at the sugar mill can be burned in the sugar mill boilers without any difficulty with a consequent recovery of heat value and improved overall efficiency. The amount of bagasse to be baled and handled also decreases by a large percentage resulting in considerable savings.

A number of patents of process exists for depithing of bagasse. For the primary stage depithing of moist bagasse at the sugar mill the system comprising vertical depither followed by screens, as shown in the flow sheet given below is effective in maximum pith removal. This system requires less power per ton of depithed bagasse and occupies less space too.

For a 2000 T/day cane crushing sugar mill producing 600T/Day bagasse, two Nos, of Vertical Depithers and two Nos, of screens are adequate. About 100-120 tonnes of pith per day is removed for burning in sugar mill boilers.

FLOW SHEET OF PRIMARY STAGE DEPITHING AT SUGAR MILL

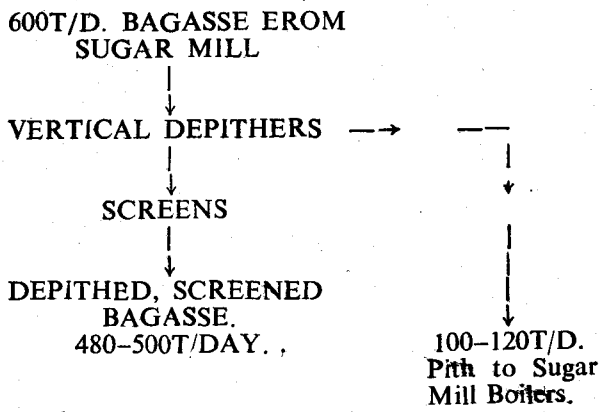

Fig.—1

Savings in transport cost of moist pith from sugar mill to paper mill and the recovery of heat value justifies the primary stage depithing at sugar mills and effects pay back of the system in a very short time.

Secondary depithing of partially depithed bagasse at 25–35% moisture by wet method of depithing in the paper mill is considered essential in order to obtain a clean fibre. The system of wet depithing comprises specially designed Hydra Pulper pith drainer and pith filter. Partially depithed bagasse in the form of bales or loose, is fed to a constant level high vortex pulper, where the bagasse slurry at 2% is maintained.

The friction produced by the high vortex of the circulating mass loosens pith from bagasse. The adhering sand and grits also get removed from the fibre. The slurry over-flowing from the pulper is pumped to a pith drainer, a drainage system where the consistency of bagasse fibre is increased to 10–12%. High pressure water sprays provided on the pith drainer further washes pith and dirt adhering to bagasse fiber. The bagasse fibre discharged from the pith drainer at 10-12% consistency is passed through a screw press. The depithed bagasse is clean and produces a good quality pulp.

FLOW SHEET OF SECONDARY STAGE DEPITHING AT PAPER MILL

Chemical analysis and fibre characteristics of well

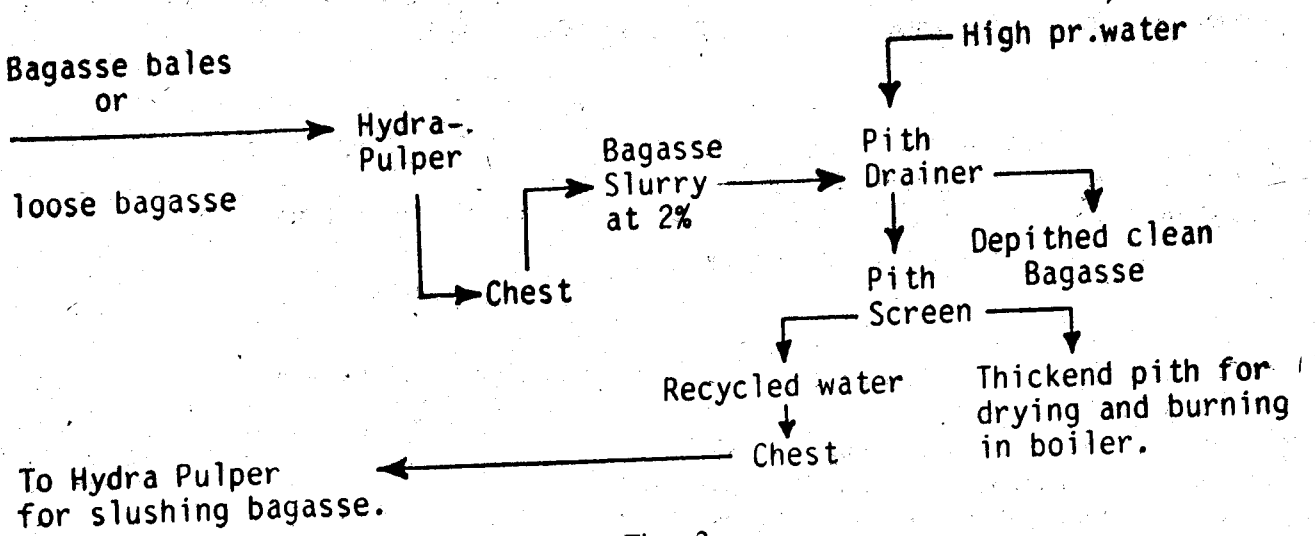

Fig.—2

depithed bagasse are acceptable for producing good quality pulp. Holocellulose and pentosans are higher than that of Bamboo and Eucalyptus hybrid and lignin is less. Fibre dimensions (Table 1) of bagasse show that it is equal or rather slightly more than Eucalyptus hybrid wood, and the length to diameter ratio is also higher.

TABLE : Fibre Dimension of depithed Bagasse, Bamboo & Eucalyptus Hybrid

S. No.	Type of Fibre	Av. FIBRE Lg. (mm)	AV. FIBRE DIAMETER MICRONS
1.	Depithed Bagasse	1.7	20
2.	Bamboo	2.7—4 0	15
3.	Eucalyptus Hybrid	0·8—1.7	20—40

TABLE II : FIBRE/PITH CONTENT OF BAGASSE AT VARIOUS STAGES

S. No.	PARTICULARS	WHOLE BAGASSE % W/W	MOIST DEPITHED BAGASSE % W/W	WET DEPITHED BAGASSE % W/W
1.	Fibre	53.2	68 6	82.0
2.	Pith & Fines	32.6	19 0	14.8
3.	Soluble Colloidal Matter & Dust	14 2	12 0	8 2
4.	Fibre/Pith Ratio	100:61.2	100:27.6	100 18.0
5.	Fibre/Soluble ratio	100:26 6	100:17 5	100:10

Bagasse fibre can be pulped easily by any conventional method of pulping either in batch digester or continuous digester. Various pulping processes are available now for bagasse pulping and the selection of one or the other process depends on a number of technical and economical considerations depending upon the end use. Bagasse is an excellent raw material for paper making and bagasse pulp blended with long fibred pulp is suitable for the production of various grades of paper. Well depithed bagasse requires only 10—12% chemical as NaOH (roughly 260—280 Kgs. of NaOH/ Tonne of Pulp) and 6—7% chlorine for bleaching in C—E—H sequence for 78°—80° PV brightness.

The economic utilisation of bagasse depends mainly in the fibre preparation—viz., Depithing in two stages at sugarmills and paper mills and the consequent recovery of pith and use of pith. If the economics are worked out on this basis it will be observed that it will be economical to replace bagasse with coal and bagasse should be made available to pulp mills by the sugar mills. This in any case, seems to be imperative if the paper mills are to be saved from shortage of firbous raw materials.

We are thankful to Mr. K. Gopalaswami, Chairman, M/s. Chellam Marketing & Consultancy P. Ltd., for his valuable guidance in presenting this paper.

References :

Mr. Misra N.D.—Indian Pulp & Paper 1965
Mr. Amrit Lal—IPPTA Conference No. 1970
Dr. B.B. Paul—IPPTA Conference No. 1970
Biswas B. & Lal—Depithing of bagasse for paper making. Sugar Tech. Association 1959.