new venture in bagasse pulping

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Bagasse fibre has been found quite useful for paper making but the pith the elimination has so far been posing a problem for the successful utilisation of Bagasse in paper making. Normally sugarcane are 'crushed' to extract the juice. The bagasse so obtained has about 30/35% with which when cooked after depithing gives rise to numerous problems due to ununiform pitch removal.

The author suggests, on the basis of laboratory trials, that 'Grinding' of sugarcane in stone grinders gives Bagasse which on cooking and bleaching yields good pulp suitable for making high grade papers. For adopting such grinding and subsequent pulping, it is essential that Sugar Mill and the Pulp manufacturing unit should be an integrated one. The process needs commercial trial to work out the comparative economics.

BAGASSE, the residue after extraction of juice from sugarcane, (Saccharum Officinarum) has not been a complete success as raw material for the manufacture of bleached and unbleached pulp for writing, printing and Newsprint paper, and also for rayon, as complete elimination of pitch has always stood in the way, though it is now established that it is one of the useful raw materials, which can be successfully used in our country. This important material is at present mostly utilised by the sugar factories themselves as fuel, but in those factories, where appreciable savings are made or where steam is generated by other fuels, the quantity of bagasse saved is available for utilisation as raw material for conversion to the above products. The storage, handling, carriage and baling of Bagasse is a big problem involving a huge capital outlay. The development of other cellulose raw material in the country is slow—therefore this raw material is the best and readily available provided care is taken from the very beginning, when the cane is crushed in the sugar mills.

The author proposes to integrate both sugar and pulp and paper mill processes by discarding the use of depithing plant in the modern pulp mill equipment and replacing grinding arrangement of sugar cane instead of the present crushing equipment in sugar mills—thus bringing a marriage of the sugar and Pulp industry. Presently, no care is taken in the sugar mills to make this useful raw material i.e. Bagasse suitable for the manufacture of pulp and the result is that lot of impurities like dirt, cane leaves, root of the sugarcane etc. are being crushed along with the cane in the convention milling plant, the result being that the pulp for the paper manufacture has to undergo a lot of drastic preparatory treatment to make it fit and suitable for the manufacture of high grade clean pulp, specially for highclass writing and printing papers, newsprint, rayon etc.

Presently the cane after bought from the growers in the sugar mills is put in the cane carrier and cut into pieces or ships and taken into the crusher and passed through several crushing mills. With this the parenchymatous cells of the cane are crushed but not broken and the result is that the final Bagasse carrying lot of pitch and residue sugar.

In the newsprint industry we have the following various types of stone grinders, with artificial or natural stones, for grinding the soft wood, and to which certain percentage of chemical pulp is added to make it suitable for the manufacturing of newsprint.

1. Three pocket grinder.
2. Waterous hydraulic grinder.
3. Warren chain grinder.
4. Great Northern grinder.
5. Ring grinder.

These grinders have been manufactured by many renowned pulp and paper machinery manufacturers and could be easily had. For continuous operations in a sugar mill, type No. 4 i.e. continuous magazine grinder should be suitable but to course subject to large scale commercial trials.

The author in the following paragraphs describes his few experiments carried out at the Forest Research Institute at Dehra Dun, where the cane was ground instead of being crushed and the results obtained were

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quite encouraging. With this method the juice is extracted, the parenchymatous cells are broken and pitch is also separated from the longer fibres of the cane. The resultant Bagasse after passing through suitable sieves and finally pressed by a conventional sugar mill's 3 roller mills comes out with very little moisture and the Pol % of sugar goes down considerably. The Bagasse thus obtained is just like a wool which could be cooked with almost 50% of alkali or other chemicals. It could be dried easily for transport to a far distant paper mill and there will be no extra cost of carriage of pith and extra moisture.

A brief review of the experiments done at the Dehra Dun Forest Research Institute on grinding of sugarcane are as under :

Sugar cane was cut into pieces of 7" size and was ground under the following conditions :—

(i) Condition of stone	...	...	Sharp.
(ii) Grinding pressure	...	...	20.2 p.s.i.
(iii) Temperature of plup in grinder pit			30 C.
(iv) Peripheral speed of stone		...	3280 fit.

The weight of sugar cane taken for grinding was 54.5 lb.. The grinder pit was filled with fresh water, weighing 208 lb.

The grinder was run for 10 minutes in which 44 lbs. of cane was ground. This consumed 3 K.W. of power. During grinding whatever water plus juice came out of pit was again put in the pit, to avoid additional use of water for keeping the stone wet.

After grinding the pulp was squeezed by hand and juice plus water uas separated from the pulp. The pulp was sorted and slivers were removed. The quantity of different products are as below :—

Wt. of juice	...	...	211.0 lbs.
Wt. of Pulp	...	...	29.5 lbs.
Wt. of Slivers	...	...	6.5 lbs.

The juice and the pulp were then analysed for sugar content, fibre & moisture. The results are as below :

Particulars	*Brix*	*Pol%*	*Purity*	*Moisture%*	*Fibre%*
Juice	2·61	1·94	74·3	—	—
Pulp squeezed by hand	2·42	1·8	—	78·78	18·8
Pulp squeezed by press	—	1·0	—	61·15	—
Washing of hand squeezed pulp	0·7	0·5	—	—	-(Pol in Pulp=0·6 Moisture in pulp= 78·14%)

By the above grinding of cane the following conclusions were arrived at.

(i) By grinding operations, the total pol percent obtained was as follows :

(a) In Juice	...	10.91%
(b) In pulp (un-squeezed)	...	1.42%
Total	...	12.33%

(ii) Grinding extraction of Pol.	...	88.48%
(iii) Fibre percent Pulp (hand squeezed)	...	18.8
(iv) Fibre percent cane	...	14.79
(v) Undiluted juice percent cane	...	21.33
(vi) Undiluted juice lost in pulp percent fibre	...	49.07

The pulp got by grinding the cane was passed over screen having 35/100 mm. slot size. The fibre retained over this screen was 10.8 percent of the total pulp on oven dry basis.

The above fibre was cooked by soda process under the following conditions :—

(i) Caustic soda on oven-day fibre	...	12%
(ii) Material to liquor ratio	...	1 : 4
(iii) Temperature of cooking	...	170 C
(iv) Period of cooking	...	4 hours Including 1½ hrs. to raise to max. temperature from room tem.

The cocked pulp gave an unbleached yield of 44.4% on oven dry fibre. The pulp was having a permanganate number of 21.8. The pulp was bleached by single stage calcium hypochlorite by using 20% available

clorine and the pulp was then washed. The bleached yield on pulp was 91.2% on O.D. unbleached pulp basin.

The bleached pulp was then beaten in laboratory Lampen Mill to 300 ml. (C.S.R.) freeness and standard sheets (I) were made. The sheets had the following physical strength properties.

Basis wt.	...	63.0 g.s.m.
Burst factor	...	21.1
Tear factor	...	47.2
Breaking length, metres	...	47.40
Stretch	...	2.0%
Folding endurance	...	20 (double folds)

From the above experiments the reader will find the low purity and low brix in the ground cane juice. The low purity was more due to stale cane brought to Dehra Dun from far distance and the cause of the lower brix was due to the primary water stored in the pocket of the stone for starting operation. This will not happen if this process is carried out continuously on a commercial or semi-commercial basis day in and day out by using fresh cane, and the water for filling up the stone pocket will be needed only once in the beginning and then the juice extracted will take its place for keeping the stone wet and cool for grinding the cane. The masceration water used in sugar mills process is about 15 to 20% which in this case will be very low thus result in saving of process steam.

The results of the cooked pulp in the above experiments are quite encouraging, and the properties of breaking length, fold, tear factor and burst factor, are quite ideal for the manufacturing of a good high grade writing & printing paper. Since the stone grinder in the laboratory at the Forest Research Institute, Dehra Dun, was of smaller size it was not possible to carry out the experiments of grinding the cane continuously for more than 10 minutes or so. The results, however, are encouraging for giving this process a fair trial on commercial scale.

Following in brief, are the main advantages of this process :—

1. A Sugar Mills milling house could be converted into a compact unit by installing one or two grinders instead of a huge 15 or 17 roller mill, with prime-movers, canecutter knives, shredders, etc.

2. More yield of sugar by complete extraction of sucrose from the cane.

3. Negligible losses in the final Bagasses as compared with conventional mills process.

4. Automatic elimination of pith with the stone grinding method, and no need of any preliminary depithing plant of Bagasse in the Paper or Pulp Mills.

5. Less chemical consumption for cooking of the bagasse pulp as the bagasse use in the industry.

6. The resulting pulp will be stronger.

7. Saving of storage space and transport expenses.

The above process needs to be tried on a commercial or semi-commercial basis for comparing the economy with the existing and the proposed processes.