

# Various considerations for releasing Bagasse from Sugar Factories for the manufacture of Paper Pulp

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With the efforts of improving the standard of literacy in the country the consumption of paper is to go up considerably. According to the estimates as envisaged in the 4th Five Year Plan<sup>1</sup> the capacity of paper industry in the country is expected to be about 1.0 million tonnes and production 0.85 million tonnes in 1973-74. India is short in the raw materials like bamboos, Sawai grass, etc. for the manufacture of paper pulp. With the envisaged target of increased production of paper pulp in the country it is very essential to tap all other available resources. Bagasse, the refuse after the extraction of juice out of the cane from the mills is being considered as a very useful material for pulp manufacture. Unfortunately, due to certain considerations enough headway has not been made in getting the bagasse released from the sugar factories for pulp manufacture in the country. This communication deals with the various considerations which are of vital importance in deciding and releasing the bagasse from the sugar factories for the manufacture of pulp.

Bagasse constitutes about 24 to 36% on cane. The production of bagasse on per unit sugar basis could be taken as 2-3.50. The bagasse production depending upon the fibre content in cane varies from 24 to 30% in low fibre regions of Maharashtra and about 32 to 36% on cane in high fibre regions of Northern India. Bagasse contains about 2.5 to 3.5% sugar and 48 to 52% water. The fibre % bagasse varies from 44 to 48. Practically all the sugar factories in India burn the bagasse in bulk in boilers in order to generate steam for

meeting the process and power demand of the mills. In fact, besides burning of bagasse in boilers in both the regions i.e. North and South, considerable quantities of extra fuel like coal, furnace oil etc. are also used. It has been, however, experienced that with the adoption steam economy measures and having equipment with better efficiencies in so far as the steam generation, consumption and per unit power generation is concerned, even the low fibred areas could become self sufficient and manage to save bagasse. The requirements of fuel in a well balanced modern sugar mill varies a round 25 to 27% bagasse on cane.

Bagasse is almost pure ligno-cellulose with a small amount of unextracted sugars, gums and waxes.

The composition of an average sample of bagasse is as follows<sup>2</sup>:

1. Lignin content	17%
2. Cellulose	57%
3. Pentosans	22%
4. Ash	3%

The fibre characteristics<sup>3</sup> of bagasse pulp together with those of other pulps are given below.

It will be seen that there is not much difference in the quality of bagasse fibre as compared with others. Besides bagasse has an outstanding advantage over other agricultural fibrous materials that it does not involve the major problems of collection.

It will thus be seen from the above that bagasse is a very useful raw material for the production of paper pulp and various cellulosic materials. Various countries have reported utilising the bagasse for the manufacture of paper, particles board, chip board, card-board etc. There are about two dozens commercial plants in the world producing pulp and paper from bagasse. The quality of paper and other products like boards etc. produced from bagasse is equal to the one produced from other raw materials. From the national economic standpoint, we can see that by using bagasse for pulp production the utilisation of bagasse on per ton basis could be much more than what it is by burning the same in the boilers. Unfortunately, the commercial utilisation of bagasse in India could not be successfully tapped so far.

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	Freemers S.R.	Average length m.m.	Average width m.m.	Ratio of L.W.	Below m.m. %	Above 1 m.m. %
1. Bagasse bleached unbeaten	150	1.216	0.0186	64.4:1	54.00	46.40
2. Bamboo bleached unbeaten	13.75	1.7072	0.0129	132.3:1	28.30	71.70
3. Sulphite bleached unbeaten	—	2.416	0.03616	66.0:1	5.00	95.00

Various difficulties that lie in the way of utilisation of bagasse as raw material for the paper and pulp industry are discussed below :

Paper Mill involves large capital outlay and therefore any down time or the mills getting stopped on account of the shortage of raw material will result in considerable losses and make the factories most uneconomical. Since bagasse is a by-product of the sugar industry, its availability to the paper mill will depend upon the stability conditions of the sugar industry. The quantities of cane crushed, sugar produced and the bagasse produced in the country for the last nine years is given below :

Season	Cane crushed 1000 t.	Sugar produced 1000 t.	Bagasse produced 1000 t.
1961-62	27,849.80	2,719.54	9,006.63
1962-63	20,702.17	2,128.82	6,469.43
1963-64	25,632.00	2,562.35	8,058.70
1964-65	33,460.00	3,231.79	10,764.41
1965-66	36,404.00	3,532.36	11,834.94
1966-67	21,659.00	2,150.70	6,887.56
1967-68	22,615.00	2,242.65	7,227.75
1968-69	34,813.11	3,290.13	11,488.29*
1969-70	44,154.99	4,140.48	14,615.30*

\* Estimated.

It will be seen from the above that the production of bagasse in the country during the period from 61-62 to 69-70 has varied from 64.69 to 146.15 lakh tonnes. The bagasse production as seen from the above statement is of very wide fluctuating nature. Before planning for a paper mill based on bagasse it is very essential that raw material for the paper mill is ensured and for this steps to stabilise the sugar industry must be taken. Recently we have also seen the fate of a few industries based on alcohol on account of the fluctuations in the total quantities of cane crushed in the sugar industry and the consequent variations in the production of molasses which is the raw material for alcohol production. Until and unless the sugar industry is stabilised and placed on a firm footing so as to avoid the ups and downs in the quantities of the cane available for sugar factories it is not safe and advisable to depend upon the bagasse for the paper mills from sugar factories. If this is not done the fate of the proposed paper mills based on bagasse as raw material will

be linked with the sugar factories. Steps required to be taken for stabilising the sugar industry is a matter of separate study and a problem by itself as such the same is not dealt here the due to paucity of space and the subject not falling within the purview of the present subject.

The sugar factory requires large amount of steam varying from 50-65% on cane depending upon the equipment and the process for meeting the demands of the manufacturing process. The production of power in a sugar factory is a by-product and the steam after generating this power is used for the manufacturing process. There are, therefore, two ways of releasing the bagasse for the manufacture of pulp for the paper factory.

1.(a) To improve the steam generation efficiency at higher working pressures.  
(b) To reduce the steam demand for the manufacturing process.

(c) By the adoption of various steam economy measures in the sugar factory.  
(d) By having prime movers having less steam consumption. Bagasse thus rendered surplus by the adoption of the above steps could be made available to the paper factories. This arrangement would not disturb the sugar factories without requiring to arrange for an alternative fuel by way of either coal or oil. By the adoption of various steps like the generation of high pressure of steam, excessive vapour bleeding, the use of vapour line juice heaters, vapour cell using efficient power generating equipment having normal efficiency of steam consumption, it is possible to manage the requirements of fuel in a sugar factory corresponding to about 22 to 25% bagasse on cane. This would mean that about 5 to 10% bagasse could be made surplus by the factories. In a 1200 tonnes plant crushing for about 120 days the surplus net bagasse on an average basis of about 7% on cane, will be to the extent of about 10,000 tonnes. Assuming 16 lbs. of pulp from 100 lbs. wet bagasse as emerging out of the mills for a normal paper mill producing about 100 tonnes of paper per day the total annual requirement of 20 to 22 lac tonnes will be met by a group of 18 to 22 sugar factories of the same capacity to feed this paper mill. Even in this proposition though appearing to be very sound feasible and easily work-

able, there are various problems involved in it. The sugar industry in North is very old and the factories are having very old and outdated equipments. The steam generation is very inefficient producing steam at low pressures varying from 100 to 160 p.s.i.g. The units producing power are very old and inefficient with high consumption of steam. In order to make the factories well balanced and adequately surplus in bagasse to meet the above requirements step will have to be taken to replace the equipments like the steam and power generation units, various equipments like pans with adequate heating surface and addition of vapour cells, vapour line juice heaters, etc. etc. All these need finance. Since the sugar industry in North is in doledrums on account of poor recoveries and the fluctuations in the availability of cane and no incentive for investment in the sugar price it is difficult to find finance by the factories themselves. In case it is decided to utilise saved bagasse from the sugar mills, the Government has to very seriously consider finding out the financial resources to meet the cost of modernisation and renovations so that the factories under all circumstances are able to save bagasse regularly for supplying to paper mills. Since the paper mills will be ensured of raw material for future they may consider meeting a certain portion of financial needs of sugar mills for modernisation on pre-settled terms which can, however, be adjusted against the cost of Bagasse.

2. The other alternative is to change the existing boilers of sugar factories completely for coal and or oil burning and release the whole of bagasse for pulp manufacture. Under this proposal, it may, however, not be essential to replace or modernise various equipment as needed proposal (1) as discussed above. The steam and power generating equipment may for some time in initial phases remain the same though slightly inefficient but the furnaces will have to be required to be replaced by chain grate stokers in case the coal is required to be used or oil burners in case oil is required to be used. For replacement of bagasse fired boilers furnaces into coal fired ones with chain grate stokers or with oil firing arrangements, the paper mills may have to consider this as their own project. Proper allowance in the cost of Bagasse to be

purchased should also be made for the interest involved in blocking the capital in the storage of alternate fuel. The cost of handling and baling the bagasse at the factory has to be also accounted for.

In order to release the bagasse wholly or partially, there are a few considerations which the sugar factories would like to be fulfilled.

- (a) The sugar mills would like that there is a constant and regular disposal and outlet for either the saved bagasse or the substituted bagasse as in case of difficulties in disposal, the factories have to make arrangements for the storage and handling of bagasse in their premises. Bagasse being inflammable, there are dangers for fire hazards and as such the factories would not like to keep abnormal stocks with them.
- (b) Investigations may be required to find whether there is any effect on the quality pulp produced by the stored bagasse and if so, to what extent. Will this involve any difference in the purchasing price of this bagasse?
- (c) The paper mills will have to ensure a proper purchasing value of the bagasse which will, however, depend upon the following factors :
  - (i) Whether the substituted fuel is coal or oil. The recommendations of the Joint Committee of the sugar and Paper Development Councils regarding the utilisation of bagasse for manufacture of paper/pulp has, however, advocated that the coal should be the only substitute fuel for releasing bagasse because of the high cost of furnace oil.

In order to fix up the proper purchasing value of bagasse comparative valuation of calorific values of bagasse and coal has to be made. For arriving at the figure of ratio of coal to bagasse the efficiencies that could be realised in properly designed steam generating equipments need also to be considered. The calorific value of bone dry bagasse has been reported to 8280 Btu's/lb. The Gross Calorific value of bagasse with Pol. % Bagasse 2.0 and 48% moisture is 4260 Btu's

based on the Princen Geerligs Formulae modified by J. Singh<sup>4</sup>. Burning efficiency of about 60% in bagasse fired boilers can be considered as normal. With a calorific value of normal coal of about 9000 Btu's/lb. and with a coal burning efficiency of about 70% a ratio of 1:2.5 in respect to coal to bagasse is available and this ratio of coal to bagasse of 1:2.5 could be fairly acceptable to the sugar factories. Similarly in case of regions like Maharashtra and South where it may be economical to use furnace oil the ratio of oil to bagasse as emerging out of factories could be 1:5.5 based on the furnace oil calorific value of about 18000 BTU and with an efficiency of about 76%.

(ii) In case of alternate fuels the sugar factories have to arrange for proper handling, storage and keeping adequate stock of coal or fuel oil. This would not only involve capital outlay but also the blocking of money in keeping certain stocks of coal or oil always to meet the requirements. Normally the sugar mills are either not interested or not in a position to incur the expenditure on the conversion of the existing boilers or the installation of the new boilers. The paper mills may have to undertake this expenditure as a part of their own project.

(iii) Bagasse rendered surplus with the improvement in the thermal efficiency as in proposal (1), has to be collected from the large number of factories. Therefore, it will be very essential for putting a new paper mills around the group of 18-20 sugar factories so that the bagasse is drawn from the sugar factories within the minimum possible distance. However, in case of the existing paper mills depending upon its location this proposition may not be workable as it may be difficult for them to draw bagasse from a large number of sugar factories and probably to feed these paper mills, if large number of sugar factories are not existing around that paper mill the sugar factories may have to be modified so as to release their all the bag-

asse by completely switching over to coal or oil burning.

(iv) The quantity of coal required to be used in the sugar factory will depend on its calorific value and the ash contents. The sugar factories should be ensured to get the coal of a uniform quality. Considering the calorific value of this uniform quality of the fuel and normal steam generation efficiency the cost of the substitute or alternate fuel will have to be worked out.

(v) Even for emergencies besides coal burning, arrangement for alternate fuel like furnace oil may have to be kept as standby. This is very important especially from the point of view of labour troubles increasing every day in the country and with the increased traffic movement in the railways. Such an eventually should also be taken into consideration while considering to release 100% bagasse from the sugar factories.

Pith in bagasse is a necessary vice in the utilisation of bagasse as a source for paper making from the point of view of cost of production as well as quality of the pulp. Paper mills, therefore, have to thoroughly depith the bagasse before digestion. In order to reduce the transportation cost probably it would be in the interest of paper mills to have depithing of bagasse under their supervision at the sugar mills. Various details in respect to depithing whether dry or wet, the recovery of fibre after depithing cost of depithing etc. may have to be worked out mutually between the factory and the paper mill. If it is agreed to have the depithing done at the sugar factory the pith could be retained by the sugar factory and a suitable rebate given in the cost of bagasse. The pith has been considered as having nearly the same calorific value as that of bagasse. Its burning alone in the boilers continues to be a problem. However, after mixing with other fuels it has been successfully utilised as fuel. In case pith is retained by the sugar factories the boilers should also have the provision of its burning.

The quantity of the bagasse produced and the moisture % etc. will have to be ascertained on the basis of the data as

reported in the Excise Department. Though the valuation of bagasse will be on the basis of bone dry bagasse, suitable allowance may have also to be given for the factories using crush crush or O.C. filters.

The present communication deals with various communications which may have to be kept in view for getting the bagasse released either partially or wholly from sugar factories for the manufacture of pulp for paper factories. Since the bagasse is a very use-

ful raw materials for paper mills it is in the national interest not to burn the same but to ensure its much better and economic utilisation in the paper industry. The problems involved for the sugar industry in releasing the bagasse wholly or partially as discussed in this paper are too many and innumerable and being of major importance for its direct working various considerations have to be properly discussed and settled mutually before actual steps are taken in this direction.

#### REFERENCES :

- (1) 4th Five Year Plan 1969-74 — page 324.
- (2) International Society of Sugarcane Technologists 1956 — page 521.
- (3) Ibid — page 522.
- (4) Princen Geerligs Formulae modified by J. Singh Ann. Progress Report 1955-56 — Scheme for a Survey of the causes of Excessive Steam Consumption in Sugar Factories in India.

