

Pollution Abatement in Small Paper Mills Chemical Recovery-A Positive Solution

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ABSTRACT

Many of the agricultural residue based Small Paper Mills have been switching over to costlier waste paper and purchased pulp to reduce pollution problems in the effluent. 60% of the pollution load is contributed by the pulp washing unit. The resultant black liquor from the pulp mill can be economically treated in a Soda Recovery Plant. This will result in considerable savings in the form of reduction of chemical costs. Further, the reduction in C.O.D. is substantial when compared to the conventional effluent treatment system. Chemical recovery Plant for Small Paper Mills is definitely feasible and economically viable to operate.

Small Paper Mills which account for 40% of total production of paper today, are facing a serious problem of surface water pollution and its consequent effect on their production pattern. Most of the small Mills, started as agro-based units, have been switching over to use of costly inputs like waste paper and purchased pulp since they are not able to combat this problem economically. We have been working on a reasonable economic solution suitable for small mills i.e. a chemical recovery unit, which would obviate the threat of pollution and at the same time enable the mills to use the agricultural residues as raw material.

Most of these mills use for the digestion process about 300-400 Kg. of Sodium Hydroxide per tonne of pulp produced. Many small mills using Bagasse as raw-material have not taken up depithing the Bagasse which will contribute to less pollution, better fibre yield and higher efficiency in washing. The result of this has been the discharge of about 1.5—1.6 tonnes of solids per tonne of pulp produced into the effluent stream. For example a mill having primarily bagasse as its raw-material and a production capacity of 30 TPD pulp will produce about 50 Tonnes of black liquor solids. This can be reduced to about 40 tonnes by introducing an efficient depithing system enabling burning of the pith in the boiler. Secondly, it will save additional Chemical consumed in the digestion process thereby reducing the Chemical Pollution load.

As a first step, we have already introduced a Bagasse depithing system. This is because bagasse is a more conveniently handled agricultural raw-material and being an annual crop has excellent potential to augment the fibrous raw material resources. Reasons that favour bagasse vis-a-vis other raw materials like straw, grass etc. are;

- i) Availability of Bagasse is concentrated in sugar mills whereas straw will have to be collected from far flung and wider area.
- ii) Per acre yield of bagasse is 10/15 times higher than straw.
- iii) With a break-through in the process for drying bagasse there will be an additional advantage in this respect.
- iv) Less Silica content in bagasse makes it a more favourable raw-material.

We give below the characteristics of waste water discharged from small paper mills using agricultural waste as raw-materials.*

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TABLE — A

Characteristics of Waste Water From Small Paper Mills Using Bagasse, Straw, Grass Etc. As Raw Materials.

Average waste water volume M ³ /tonne of pulp	: 250M ³
pH	: 8.5 to 10.0
Suspended Solids Mg/Ltr.	: 600
BOD Mg/Ltr.	: 1000
COD Mg/Ltr.	: 3000

TABLE — B

MINAS (Minimal National Standards) indicates the following parameters for small paper mills for discharge of their effluent into surface water/ rivers etc.

pH	: 6.0 to 9.0
Suspended solids	: 100 Mg/Ltr.
BOD at 20° C	: 50 Mg/Ltr.

In order to achieve even the MINAS-Standards indicated above, Small Paper Mills have to go in for an elaborate effluent treatment plant. Alternatively they can install a chemical recovery plant and reduce the toxic C.O.D. load effectively and recover the scarce Caustic Soda as well economically. These are discussed below.

EFFLUENT TREATMENT PLANT :

Effluent treatment plant capable of handling on an average 250M³ of effluent water per tonne of pulp produced, will have to be installed. That is to say, for a TPD bagasse/rice straw mill, it will require a plant to handle approximately 7500 M³ of effluent water per day.

From the pollution level given in Table 'A', for an effluent treatment plant capable of bringing down the level of pollutants to make the discharge fit for irrigation purposes, the capital investment will be approximately Rs. 1000—Rs. 1,500* per annual tonne production. Therefore, for a mill producing 10,000 Tonnes per annum the expenditure in capital cost will be a minimum of Rs. 1.0 Crores to make the plant effective.

Further, there will be a recurring cost of Rs. 300/- to Rs. 325/-* per tonne of paper produced or Rs. 30 lakhs per annum. The high initial capital cost and recurring cost for treatment, deter the small paper mills from taking any corrective action towards pollution abatement.

SODA RECOVERY :

Many of the Old Mills has in fact a Recovery System capable of handling upto 30/50 Tonnes black liquor solids per day using the Roaster Smelter process. Combination of a direct contact evaporator and Roaster was in use in many areas. Modern spray type Soda Recovery furnace came into existence after the post war period along with the introduction of the sulphate process in most of the mills.

As a second step we have come out with a Chemical Recovery system, which can suit the requirements of the Small Paper Mills using Rice Straw/Bagasse. This involves concentrating the black liquor which is normally available at 8 to 10% solids to 45% in multiple effect evaporators. This liquor is further concentrated to about 55 to 66% solids in a direct contact evaporator. The product liquor is then sprayed into a smelter coupled with a Waste Heat Boiler for recovery of Chemicals in the form of molten smelt besides raising steam by the recovery of heat generated in the combustion process.

RECOMMENDED SYSTEM :

- i) A five effect Long Tube Vertical evaporator (with a spare body) and a finisher effect to concentrate the weak black liquor that is normally available in Small Paper Mills at 8% to about 45%.
- ii) The Black liquor is then fed to a cascade evaporator or a similar direct contact evaporator to increase the outlet concentration of black liquor to 55 to 60% solids, which is then fed to a liquor spray type smelter having a waste heat boiler.
- iii) This will be followed by a continuous causticizing plant with drum slaker, classifier, white liquor clarifier, lime mud washer, lime mud filter etc.

We have illustrated our system in the drawing annexed. The steam generated from the waste heat boiler will meet adequately the requirements of the chemical recovery plant. It may be noted that the

Chemical Recovery Plant suggested above, eliminates basic pollutants in the form of alkaline discharge from pulping plant and also removes the highly coloured black liquor from the effluent stream. It has been estimated that the average cost of the plant to handle approximately 50 Tonnes Black Liquor Solids per day will be about Rs. 275 lakhs. The investment is worthwhile taking into consideration the various advantages derived in the form of :

- a) Continuous operation of the Small Paper Mills which have been subjected to seasonal variations.
- b) Recovery of approximately 75% of the input chemicals and thereby the reduction in the cost of pulp produced.
- c) Reduction of discharge of pollutants in to the surface waters.

A table comparing both the systems is appended.

CONCLUSION :

A study has indicated that small Paper Mills have invariably the problem of continuous operation, if agricultural wastes are used as raw-materials. This is due to pollution abatement requirements. There have been doubts expressed in various quarters on the feasibility and viability of a Chemical Recovery Plant for Small Pulp & Paper Mills having a capacity of 25 to 30 Tonnes paper production per day. It has been demonstrated in actual practice, that the chemical recovery system suggested above will obviate such doubts. Further, the Recovery system can be operated with a good degree of efficiency. It has been estimated that the cost of investment on the plant can be recovered in about seven years under the present conditions.

A COMPARISON OF EFFLUENT TREATMENT SYSTEM WITH SODA RECOVERY PLANT COST

			With Soda Recovery system	With conventional effluent treatment system
1.	Annual Pulp Production	Tonnes	12,000	12,000
2.	Bagasse Pulp 75%	Tonnes	9,000	9,000
3.	Annual caustic soda required (value Rs. in lakhs)	Tonnes	830 50	2,700 165
4.	Capital cost (Rs. in lakhs)		275	100
5.	Operating cost (Rs. in lakhs)	100		35
	Add : Extra cost on makeup caustic soda purchased (Rs. in lakhs)	50		165
	Total (Rs. in lakhs)		150	200
6.	Net savings/annum (Rs in lakhs)		50	—

EFFLUENT CHARACTERISTICS

		With Soda Recovery system	Without Soda Recovery system
1.	Waste water volume in M ³ /tonne	300/400	300/400
2.	Colour	Light brown	Dark brown
3.	pH	6.5	8.5
4.	Total solid Mg/Ltr.	1500	5400
5.	BOD Mg/Ltr.	350	1020
6.	COD Mg/Ltr.	1280	3500

Reference :

* Comprehensive Industry Document for Small Paper Industry by Central Board for the prevention and control of water pollution.

