

# Cost Reduction of Different Chemicals Used in Paper Industry.

PANDEY S. N., GHOSH I. N. AND DAY A.\*

## ABSTRACT

Due to the increasing prices of various chemicals used by the Pulp and Paper Industry, attention has been given to minimise their uses. This can be done mainly by reducing the use of cooking chemical additives needed for paper making or replacing the expensive chemicals by cheaper materials.

## INTRODUCTION

In pulp and paper Industry, various chemicals are used from initial stage of pulping to the finished products. In India, bamboo, wood, bagasse, waste paper, straw etc. are the main ligno-cellulosic raw materials used in Paper mills. (Table-I)

In order to get the cellulose pulp for paper making,

the raw materials are digested by different cooking chemicals like caustic soda, mixture of caustic soda and sodium sulphide, lime, sodium sulphite etc by different processes, Besides, many other chemicals like bleaching powder, calcium hypochlorite, rosin, soap and alum, different dyes and pigments, natural and synthetic polymers, defoaming agents etc. are used to make the finished papers. A list of various chemicals and their uses is given below :—

Table—II

Type of Chemicals	Examples	Purpose of their uses
1. Cooking Chemicals	Caustic Soda, sodium sulphide, lime, soda ash, sodium sulphite, etc.	To get pure Cellulose pulp from ligno-cellulosic raw materials after removal of lignin and other materials
2. Bleaching Chemicals	Chlorine water, chlorine compounds, calcium hypochlorite, and sodium hypochlorite, sodium peroxide, magnesium sulphate, etc.	To get white paper of desired brightness
3. Sizing Chemicals	Rosin-soap, sodium silicate, alum for pH control etc.	To improve the surface finish and other characteristics
4. Loading Chemicals	Kaolin, calcium carbonate, titanium dioxide, zinc sulphate etc.	To reduce the use of expensive cellulose fibre.
5. Adhesive Chemicals	Casein, guar gum, starch synthetic latex, UF, resins etc.	To improve the strength properties of paper.
6. Colouring Chemicals	Various pigments and organic synthetic dye stuff (basic, direct or vat dyes)	To produce coloured paper or to adjust the tone of white paper.

\*Jute Technological Research Laboratories, (ICAR)  
12 Regent Park, Calcutta-700 040.

Due to the increasing prices of these chemicals day by day, it is now necessary to minimise their uses in Pulp and Paper mills. This can be achieved mainly by reducing the use of high cooking chemicals at the pulping stage and also reducing the amount of chemical additives added during the stock preparation. In view of the shortage of paper making raw materials throughout the country, (Table-III) attention has been given to use non-conventional raw materials like agricultural residues viz Jute and mesta-stick (2,3,4), cotton stalk (6), rice straw (5), etc. and to produce high yield pulps (4) by the use of lesser chemicals.

Table-I

Distribution of raw materials used in paper making.

Serial No.	Mill Category	Raw materials	Approximate Usage (%)
1.	large	Bamboos	75
		Hardwood	22
		Softwood	1
		Others	2
2.	medium	Agricultural residues	80
		Waste paper	15
		purchased pulp	5
3.	Small	Agricultural residues	40
		Waste paper	60

Source : Ippta, March 1985, 22, No. 1, p.4, Part-I.

Table-III

Figure about installed capacity, production and demand of Paper and Board in India.

Annual Installed Capacity	Demand	Production	Gap between Production and demand
2.164 million tonnes	1.482 million tonnes	1.178 million tonnes	0.304 million tonnes

Source : Ippta, March 1985, 22, No. 1, p273, Part-II.

#### WORK DONE AT JUTE TECHNOLOGICAL RESEARCH LABORATORIES, CALCUTTA

It has been found through research investigations at JTRL, Calcutta, that jute stick, mesta whole plant etc., are promising raw materials for making pulp, paper and newsprint (2,3,4,5).

The kraft process (3) needs cooking by 20% chemicals to give pulp of 48% yield whereas the high yield pulping processes of the same raw material (Sl. No. 2-4, Table-IV) give pulp of 65%-85% yield using only 10% chemicals (Table-IV).

TABLE - IV

Comparison of pulping properties of high yield jute stick pulp with those of chemical pulp

Sl. No.	Type of pulp	Chemicals as NaOH (O D. basis)	Temp. °C	Yield of Pulp	Breaking length (m)	Fold	Permanganate no.
1.	Chemical pulp (un-bleached, kraft)	20%	165	48%	7500	240	15
2.	Mechanical pulp	—	Room Temp.	90%	2000	2	very high
3.	Cold soda chemimechanical pulp (unbleached)	10%	Room Temp.	85%	4000	9	>25
4.	Hot soda chemimechanical pulp (un-bleached)	10%	90-95	65%	5000	15	>25

From table IV, it is evident that kraft process gives bleachable grade pulp unlike the high yield pulping processes which need more bleaching chemicals to get the desired brightness. However, if the paper is used for ordinary unbleached purposes (e. g. corrugating medium, wrapping and packaging paper etc.) the use of higher bleaching chemicals can be avoided.

It is also seen that the high yield pulps are inferior to chemical pulp in respect of strength properties. This can be improved by mixing of high yield pulps with some other high strength pulp or by adding some vegetable gums during the stock preparation.

#### IMPORTANCE OF CHEMICALS ADDITIVES IN PAPER MAKING :

In pulp and paper making, the role of chemicals additives cannot be ignored as the pulp slurry without additives after beating or refining may produce paper that is lacking in several desirable characteristics such as surface smoothness, sizing, colour etc. Removal of these deficiencies require numerous additives (Table-II) to be added during stock preparation. In order to bring down the cost of production in paper mills, loading and filling of paper have been the common practice which is usually done by replacing the more expensive cellulose fibre with cheaper minerals. The fillers make paper more useful as they improve the printing properties by improving the brightness and opacity, give better finish on calendering.

Talc, clay, titanium dioxide, calcium carbonate are the principal loading chemicals used in paper industry. As titanium dioxide is expensive than talc and clay, the later two will be preferred by the paper maker for economic reasons (1,7).

#### SUGGESTIONS FOR ECONOMIC USE OF CHEMICALS :

1. In pulping processes, the amount of costly caustic soda used may be replaced by lime, sodium carbonate or sodium sulphite for better pulp yield and easy bleachability.
2. The production of high yield pulp using lesser chemicals at the pulping stage has been suggested earlier.

3. The chemicals that are generally used by the paper mills, big or small, are sizing chemical mainly rosin and alum. Although considerable amount of work has been reported on use of these materials but there is urgent need for further work. Therefore, it is suggested that research work should be carried out to minimise the amount of rosin consumption also can be reduced by proper technique by addition of required amount of sulphuric acid to the dilute solution of alum by proper mixing with the stock. Moreover, the cost reduction can be very well done with the use of cheaper and effective types of wet end additives like tamarind kernal powder (TKP) in place of costly guar gum and other additives available in the market.

#### ADVANTAGES IN SAVING OF CHEMICALS :

1. By reducing the use of costly chemicals in pulp and paper industry, the production cost will be sufficiently reduced.
2. Consumption of less chemicals by paper mills means less effluent as a result of which there will be less pollution.
3. Corrosion of plant machineries by different chemicals will be less due to less consumption of chemicals by the industry.
4. As the agricultural residues generally require less chemicals for pulping, the use of these materials will therefore, minimise the chemicals consumption.
5. With the rapid growth of civilisation the demand of paper will increase. As a result, the forest resources will also be depleted. The use of agricultural residues as alternative source of raw materials will not only reduce the deforestation but also preserve the greenery.

#### SUMMARY :

To summarise, different chemicals are consumed by the Pulp and Paper Industry at different stages. By adopting the process of high yield pulp making using lesser chemicals particularly from agricultural residues like jute-stick, mesta-stick, cotton stalk etc, it is possible to reduce the cost of production. (A calculation for a mini - paper plant based on jute - stick producing

ordinary qualities of packaging paper has been done and about 30% cost reduction was found to be possible). The use of other chemical additives may also be lowered and controlled in order to make the process economic.

#### REFERENCE :

1. Hand book of Pulp and Paper Technology by K. W. Britt, p. 316.
2. Newsprint grade pulp from whole mesta plant, Bannerjee, S. K., Day, A., Ghosh, I. N. and Deb Sarkar, N. L., IPPTA, 22, Sept., 1985.
3. Some studies on sulphate pulphate pulping of jute stick, Ghosh, I. N., and Sanyal, A. K., IPPTA, Oct-Dec, 1976.
4. High yield pulp from jute stick, Guha, A. K. and Sanyal, A. K., IPPTA, March, 1981.
5. Low cost jute stick pulp for mini paper plants, Sanyal, A. K., Roy, A. K. and Ghosh, I. N., IPPTA, Oct-Nov, 1981.
6. Production of various grades of paper from cotton stalk, Pandey, S. N. and Shaikh, A. J., Indian Pulp and Paper, Dec., 1985.
7. Paper Pulp and Speciality Papers, Small Industry Research Institute Publication, New Delhi-110007, p. 280.