

Role of Handmade Paper Units in Improving Paper Quality and Efficiency of Recycled Waste Paper Based Mills

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ABSTRACT

Most of the handmade paper units are producing long fibers pulp from the white cotton rags with very high alpha cellulosic content. This pulp is dried in the form of pulp sheets in open sun without using any electric or steam energy. Such pulps can be used as a reinforcing pulp for improving poor quality of recycled waste paper pulp and to produce quality papers. In this way, the handmade paper units can play a vital role in improving the paper quality as well as to ensure the smooth running of the recycled waste paper based paper mills. Demand of cotton rags pulp by mill sector will provide more opening for handmade paper units.

INTRODUCTION

Indian paper industry is facing number of problems. Availability of suitable quality of raw material in sufficient quantity is a main bottleneck before the industry. Generally, soft wood, bamboo and hard wood are considered to be the important raw materials for superior quality paper and paper product. Soft wood is considered to be the best raw material due to its long fiber. In the country, availability of the soft wood is almost negligible mainly for the pulp and paper industry. In general, most of the large paper mills in the country are based on forest based raw materials like hard wood Eucalyptus with different proportions of bamboo. Such mills are well equipped with chemical recovery units and produce limited quantity of pollutants during bleaching and other operations.

Agro based raw materials like wheat straw, rice straw, bagasse etc. are used by many medium and large paper mills. Most of the medium mills are not having chemical recovery units and draining huge quantity of pollutants, generated during pulping operation, into stream along with pollutants generated during bleaching and other operations. Due to many other use of agro based raw materials like use of wheat straw as cattle feed, bagasse as a boards building materials and as a fuel for industrials and power boilers, the agro based raw materials are also getting in short supply day to day. Due to increasing awareness of environmental protection, recycling of used paper is encouraged because of very little quantity of pollutants generated during its processing like pulping, slushing, deinking,

bleaching, beating and refining etc. Moreover, pulp produced is generally bleached to desired brightness level with non-chlorine based bleaching chemicals like hydrogen peroxide. In addition, there are many advantages like low cost compared to virgin fibers, less capital investment compared to processing of other raw materials like wood and agro based, less load on forest, eco-friendly process in manufacturing from waste paper etc.

Types of Waste Paper

Different types of waste paper are being used. Some of them are imported waste paper, OCC, craft waste, wood free paper waste, mixed paper waste, white paper cuttings, old note books, magazines and newsprint etc., depending upon the paper to be produced. For writing, printing and some other grades of paper, white paper cutting, used stationery, used note books etc. are being used. The quality of the waste paper obtained from different sources varies very widely depending upon the furnish of different waste papers and processes involved during paper production. In general, recycling of waste paper reduces fiber swelling properties, fiber bonding and ultimately physical strength properties of the paper produced.

Quality Deterioration During Processing

Quality mainly physical strength properties of the pulp produced from waste paper deteriorate due to number of factors involved in its processing like slushing, deinking, cleaning, bleaching, beating or refining etc. because of imparting lot of mechanical and

chemical actions. Such actions also result in fines production, poor drainage and poor runability of paper machine and frequent breakage on paper machine. The paper produced also shows poor physical strength properties. Hence, need is felt to improve the waste paper pulp quality to improve the paper quality.

Ways for Improvement

In order to improve the quality of the paper to be produced, there is always a need of improvement in the quality of the waste paper pulp. Number of options are open (i) use of extraneous chemicals such as anionic and cationic polymers. these polymers either facilitate hydrogen bonding or form electrostatic bonds between fibers and the fines produced during process and ultimately improve pulp strength. Use of sodium hydroxide during pulping process is also helpful to improve fiber swelling and ultimately fiber to fiber bonding (ii) blending of long fiber pulp with waste paper. Partial substitution of waste paper pulp with long fiber pulp from the softwood, bamboo etc. improves drainage and other physical properties of the waste paper pulp. Recently, many mills are using synthetic staple fiber, which is available as a waste from some industries like Reliance Industries to improve the drainage. Such option is not encouraging due to the facts (i) a major portion of such material is separated during screening and other operations because there is no cellulosic fiber bonding with this material (ii) use of this material is not environmental friendly because of its non-biodegradability. As far as the bamboo pulp is concerned, it is not available in the market because of poor availability and many other uses of bamboo in the country. Soft wood pulp, which is an import item is also not in much use. Another option is the pulp produced from white cotton rags, which is being produced within the country by many handmade paper units and easily available in the form of pulp sheets. Such pulp possesses excellent properties as indicated below and can be used as a long fiber substitute.

Particulars (Freeness 300 ml CSF)	Results of Cotton Pulp
Tensile Index, Nm/gm	36
Tear Factor	204
Burst Factor	38
Double Fold, No.	613
Brightness, % ISO	94

HANDMADE PAPER UNITS

In recent years, handmade paper industry has

developed its significant place in the world market because of its eco-friendly, ethnic touch and its high quality. A record increase of more than 3000% (1990-91, Rs.6.0 million to Rs. 210 million in 1999-2000) in the export of handmade paper and value added items has taken place. In our country, many handmade paper units are involved in the development of varieties of papers. The basic raw material for most of the handmade paper is cotton rags/hosiery cuttings etc. for the production of pulp required for varieties of handmade paper.

In addition to different varieties of papers produced from the pulp of cotton rags, hosiery cuttings etc. by handmade paper units, quite a large number of units are involved in the production of different types of boards from waste paper and pulp sheets from cotton rags. Many units are supplying cotton rags pulp for the production of currency note papers. Cotton rags are chopped in required size i.e.(1" to 2") in length and further beaten in a valley beater using little quantity of caustic soda which helps in fiber swelling. Properly beaten pulp is thoroughly washed and converted in the form of pulp sheets. These sheets are dried in an open sun without the use of any electric or steam energy, Capital investment is also very low in establishing such units in addition to very low cost.

Objective

In general, the pulp produced from waste paper is very weak. In order to improve physical strength properties of the paper, to be produced from waste paper, blending of cotton rags pulp may be helpful. Keeping in view, preliminary studies on the blending of cotton rags pulp with waste paper pulp is undertaken in order to see the effectiveness of cotton rags pulp blending on physical strength properties of the paper produced from waste paper.

EXPERIMENTAL

Collection of Waste Paper Pulp from the Paper Mill

Waste paper pulp is collected from a paper mill situated in U.P. i.e. Shamli Paper Mill, Shamli Road, U.P. The pulp produced was from Indian waste paper mainly from white paper cuttings and other sources. Around 3.5% caustic soda is used during slushing of this paper. The pulp collected from the mills is bleached in the laboratory. Both bleached and unbleached pulps were evaluated for physical strength and optical properties.

Preparation of Cotton Rags Pulp

The cotton rags, mainly the white hosiery

cuttings, were collected for producing cotton rags pulp. The laboratory beater was used for beating the rags under specified operating conditions. The cotton rags were beaten to two different freeness levels i.e. 500ml CSF and 300 ml CSF. The physical strength and optical properties of the rags pulp were determined for each of the above two pulps.

Blending Studies

The rags pulp of 500 ml CSF and 300 ml CSF were blended separately with bleached waste paper pulp of 300 ml CSF in different ratios i.e. 1:99, 2:98, 5:95, 10:90 and 20:80 and hand sheets were produced. These hand sheets were evaluated for the physical strength and optical properties.

RESULTS AND DISCUSSION

Table-1 indicates the physical strength and optical properties of waste paper pulp (at 300 ml CSF) and cotton rags pulp (at 500 ml CSF and 300 ml CSF). It is evident from the table that the rags pulp is having excellent tear index and folding endurance as against

that of waste paper pulp. Further, these physical strength properties of rag pulps are better at 300 ml CSF level as compared to that of 500 ml CSF level.

Table-2 indicates the results of blending of rags pulp of 500 ml CSF with the waste paper pulp. It is evident from the table that as we are increasing the proportion of rags pulp, the strength properties are also improving. Percentage increase in physical strength properties is depicted in Fig. -1.

Similarly the results of blending of cotton rags pulp of 300 ml CSF with waste paper pulp are shown in Table -3 and percentage increase in physical strength properties is depicted in Fig.-2. The physical strength properties are showing an improvement with the increase of cotton rags pulp proportion. Comparing the two experiments above, it appears that the blending of cotton rags pulp of 300 ml CSF with waste paper pulp shows very encouraging results.

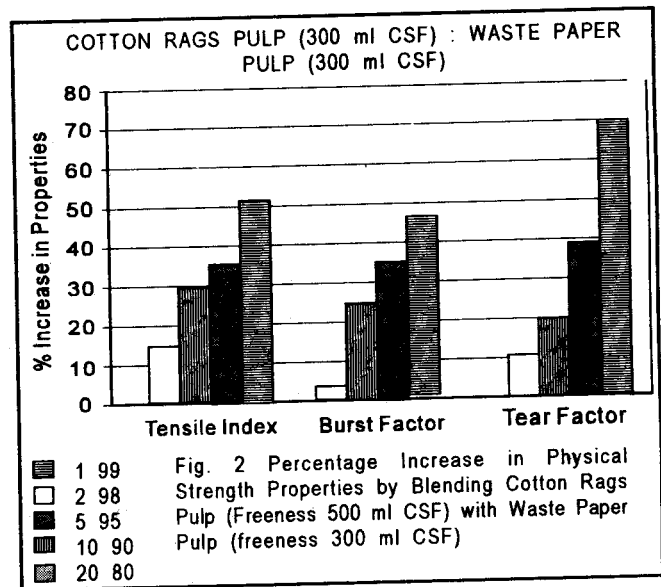
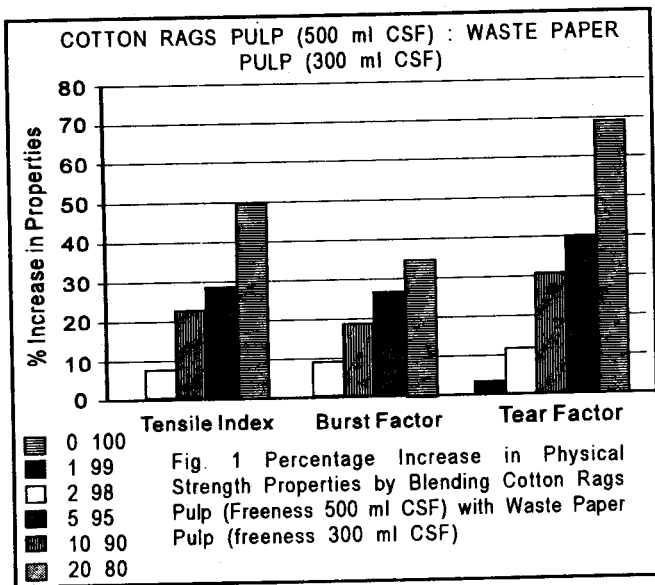
Table-4 indicates the cost economics for cotton rags pulp produced in handmade paper units. It is evident from the table that rags pulp may cost

Cotton : Waste Paper	Tensile Index Nm/gm	Burst Factor	Tear Factor	Folding Endurance (No. of Double Folds)	Brightness % ISO	Drainage Time Seconds
0:100 (300 ml CSF)	14	11	66	6	73	14
100:0 (500 ml CSF)	24	20	135	38	94.1	4
100:0 (300 ml CSF)	36	38	204	613	94	7

Cotton : Waste Paper	Tensile Index Nm/gm	Burst Factor	Tear Factor	Folding Endurance (No. of Double Folds)	Brightness % ISO	Drainage Time Seconds
0:100	14	11	66	6	73.0	14
1:99	14	11	68	7	74.2	9
2:98	15	12	74	10	75.1	8
5:95	17	13	87	18	77.1	8
10:90	18	13	92	20	79.2	7
20:80	21	15	111	27	82.3	6
100:0	24	20	13	39	94.1	4

TABLE-3
Effect of Blending Cotton Rags Pulp (300 CSF) with Waste Paper Pulp (300 CSF) on Physical and Optical Properties

Cotton : Waste Paper	Tensile Index Nm/gm	Burst Factor	Tear Factor	Folding Endurance (No. of Double Folds)	Brightness % ISO	Drainage Time Seconds
0:100	15	11	66	6	73	14
1:99	14	11	66	6	74	13
2:98	16	12	68	11	75	12
5:95	18	13	80	14	77	11
10:90	19	15	85	16	79	9
20:80	20	19	97	29	82	8
100:0	36	38	204	613	94	7



approximately Rs. 30-35/- kg. Though this cost is quite high as compared to waste paper pulp produced in the paper mills, because of very low percentage required for blending, the ultimate cost of the blended pulp will

far better than the blending of the non-biodegradable synthetic staple fiber.

Cost of Cotton Rags Rs/kg	Cost of Chemicals Electricals Rs/kg	Cost of Labour	Cost of Cotton Rags pulp Rs/kg
20.00-22.00	7.00-8.00	3.00-5.00	30.00-35.00

be much less. Moreover, the blending of biodegradable cotton rags pulp with waste paper pulp is

CONCLUSION

From the above studies, it is concluded that blending of little proportion of cotton rags pulp with waste paper pulp can improve the physical strength properties, drainage etc., which ultimately improve the smooth running of the paper mills. Proportion of the blending of rags pulp will depend on the required properties of the paper produced and also on the over all economy of the paper production in the mills. The requirement of rags pulp sheet by mill sector will open up more demand for handmade paper sector.