Studies On Dispersion Of Wet Strength Papers During Recycling

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ABSTRACT

Secondary fiber is going to be one of the major fiber resources for the paper industry in coming years. Our paper industry is utilizing substantial amounts of waste paper imported firm different countries. Wet strength paper, used for packaging of agricultural and cement products, is one of the varieties among imported waste paper. Conventional hydrapulpers, used for processing of broke, are commonly emplyed for slushing of the waste paper. It was observed that unlike other grades of waste papers (eg : computer print out), wet strength paper poses problems in slushing operation due to presence of wet strength resins. Present paper discusses the results of the studies conducted for optimizing the process conditions during repulping of wet strength papers. Studies reveal that efficent dispersion of fibers could be achieved by slushing at temperature above 70°C in the pH range of 3-4. The strength properties of pulp, with efficient fiber separation, were better than the pulps dispersed under normal temperature and pH conditions

To augment the raw material situation and to achieve sustained production of paper and paper products, there will be an increasing thrust on the usage of waste paper. It is estimated that about 85% of the paper and board consumed in our country could be theoretically recovered[1]. However creation of market and demand will be important aspects to make waste paper collection more attractive. Important constraints, currently faced in the recycling of domestic waste paper are (i) Lack of method for efficient removal of contraries, (ii) reduction in strengsh properties during recycling and (iii) possible health hazards and aesthetic factors. Due to these constraints the domestic waste paper is not attracting the consumers. Small mills are using substantial proportion of the waste paper for production of cheaper varieties of paper and paper products. Better methods of collection and cleaning of waste paper should facilitate the increased use of this secondary fiber source in writing, printing and other fine papers. When the raw material became the major constraint faced by the industry, GOI liberalized its policy of import and permitted the import of waste paper. It has been experienced that the imported kraft grade waste paper is a better source of long fiber than indigenous bamboo virgin pulp. Imported waste paper generally is comprised of computer print outs (CPO), kraft paper and wet strength papers. While processing wet strength papers, some of the mills have experienced that unlike other grades of paper it is difficult to disperse the fibers during slushing of wet strength papers. Waste paper from corrugated board, solid case boards and wet strength paper often contains wet strength additives, like urea formaldehyde and malemine formaldehyde resins[3]. These resins become water insoluble components when the web comes out of the dryer section which makes the wet strength papers resistant to dispersion under the normal pH and temperature conditions. In the literature[2] higher temperature and lower pH conditions are recommended. The present study was taken up to optimize the process conditions like temperatures, consistency and pH during repulping operations. The sample of wet strength paper, studied was imported multiwalled sack used for packaging of cement and agricultural products. The advantages of efficient dispersion with respect to strength development was also studied.

RESULTS AND DISCUSSIONS :

In fiber dispersion experiments two variables were chosen–one was elevated temperature (around 80° C) and the other variable was pH range, In all cases the dispersion was not favourable with the stock consistency below 5%.

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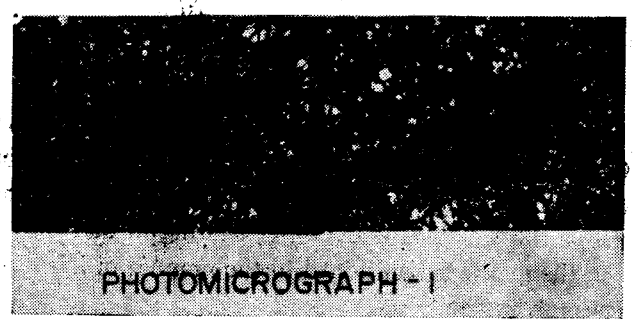
Dispersion under normal pH and temperature conditions :

Preliminary dispersion experiments were carried at 25-30° C with 5% consistency. Before dispersion this sample was allowed to soak in water for 10 minutes. Dispersion was carried out in a laboratory blender. After dispersion the stock was diluted to 0.25% consistency for visual observation and freeness measurement. Stock obtained after dispersion had a pH around 6.2 Fibers were not dispersed efficiently and stock contained undispersed fiber bundles. The freeness value was 720 ml, CSF. These experiments clearly showed that it was difficult to disperse the fibers under normal temperature and pH conditions. (Photomicrograph—1)

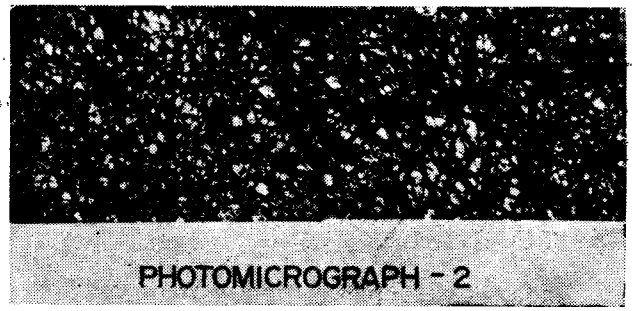

PHOTOMICROGRAPH - 1

Dispersion at elevvted temperature : Except the temperature, in this case. the dispersion was carried out under the conditions similar to these maintained in cold dispersion. The temperature during dispersion was kept 80° C. Stock obtained in hot dispersion also had the freeness value around 720 ml, CSF with distinct fiber bund'es, showing poor separation of fibers, It was concluded that only increasing the temperature will not facilitate efficient dispersion of fibers.

Dispersion at 3–4 pH in cold conditions : Here the pH of dilution water was reduced to around 3-4 by addition of sulfuric acid and the paper sample was then dispersed under the similar conditions. With reduced pH of the stock there was a marginal improvement in fiber separation and the freeness value of 695 ml, CSF was obtained. However visual observation of diluted stock showed that the fiber separation was not satisfactory and fiber bundles continued to exist.

Dispersion at elevated temperature with 3–4 pH range :

In this case dispersion was carried out at a temperature around 80° C with lower pH range (3-4). After disintegration the pH of the stock was around 6–7. It was observed that in this case, there was an efficient separation of fibers which was supported by the fact that the freeness value reduced to 500 ml, from 695 ml. The diluted stock was completely devoid of any fiber bundles. Thus lowering of pH followed by hot disintegration was highly effective in eliminating the adverse effect of wet strength resins. The quantity of the acid required, to bring down the pH range to 3–4, would be about 17 kg of 90% pure sulfuric acid per tonne of O. D pulp in the stock at 5% consistency. (Photomicrograph—2).


PHOTOMICROGRAPH - 2

Strength properties : Strength properties of pulps with wall dispersed fibers (low pH and temperature around 80° C) and poorly dispersed fibers (normal pH and temperature) given in Table 1, clearly indicate that extent of fiber separation during repulping is an important factor which influences the strength development. Pulp (A) with poorly dispersed fibers even upon beating showed lower strength properties as compared to the strength properties of pulp with well dispersed fiber (B). It can be observed that pulp B had better strength properties even before beating, as compared to unbeaten pulp (A). Thus the efficient operation of fibers, during slushing and repulping operation, will facilitate in having the pulps with improved strength properties.

CONCLUSION :

1. Studies indicate that pH value during dispersion has more influence than temperature on fiber separation.
2. The effect of pH is more pronounced at elevated temperature.
3. pH values between 3-4 and temperature preferably above 70° C are the optimum conditions for efficient" separation of fibers during repulping operation.
4. Higher consistencies would be preferable.

TABLE—1

STRENGTH PROPERTIES OF RECYCLED WET STRENGTH PAPER

Pulp No.	PFI (rev)	Freeness ml, CSF	Drainage time (s)	Apparent density (g/cm³)	Burst index (kPa.m²/g)	Tensile index (N.m/g)	Strech (%)	Fold (Kohler Molin) log.	Tear index (mN.m²/g)	Air resistance Gurley (s/100ml)
A	0	720	3.85	0.58	1.25	25.0	1.6	1.71	14.3	3.6
	6000	355	6.30	0.74	4.35	63.5	3.0	2 96	9.60	150
B	0	585	4.05	0.65	2.90	43.5	2 6	1.95	14.5	12 3
	6000	235	7.00	0.76	6.70	83.0	3.7	3.10	8.70	290

A. Disintegrated at ambient temperature with no pH adjustment.

B. Disintegrated in hot (70-90°C) with pH of stock adjsted to 3.0

EXPERIMENTAL :

Imported waste paper samples were collected from a mill. Samples consisted mainly of bleached and unbleached multiwalled sack paper (wet strength paper) used primarily for packaging of cement and agricultural products. It was presumed that waste paper may be containing urea formaldehyde and/or melamine formaldehyde resins which are usually added as wet strength resins. The paper was first cut into small pieces of size 1 cm x 1 cm The moisture content was determined after uniform mixing. For small scale trials 5 gms of O. D. samples were used. After optimizing the conditions on small scale the results were confirmed by dispersion 100 g of samples. Cut sample were soaked in water for 10 minutes before it was subjected to disintegration. Consistency of 5% was maintained in all the cases and the dispersion was effected in a laboratory blender with a timer. The dispersion time was kept constant (3 minutes) in all experiments. Stock was diluted to 0.25% consistency for visual observation.

For hot disintegration sample was heated to 80-90° C with water at pH 3–4 with 5% consistency, for about 60 minutes and then dispersed in blender. Strength properties were evaluated, after beating in PFI mill, as per the methods mentioned in the manual of laboratory research methods[3].

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