World Applied Sciences Journal 12 (11): 1987-1988, 2011
ISSN 1818-4952

Effect of Beating Value on Bagasse CMP Pulp Fiber Characteristics

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Abstract: This research was aimed to evaluate effect of beating value on CMP pulp fiber characteristics, made from Bagasse. Cooking factors in pulping stage were as: cooking temperature 160°C, cooking time 40 min and Sodium Sulphite 15%. PFI mill with different revelation as 2500, 3000, 3500 and 4000 was used for pulp refining. Analysis of variance of fibers was conducted using completely randomized design, then mean values were compared, using Duncan's test. Results showed that between Fiber length and diameter, lumen diameter, fiber wall thickness, before and after refining, were significantly different at the level of 95 percent. Increasing refiner revolution to 3500 caused significantly lower value for fiber characteristics; but by increasing refiner revolution to 4000, was found no significantly different at the level of 95 percent. Optimizing refiner revolution was suggested 3000, with fiber characteristics and pulp freeness 406 CSF.

Key words: Beating value · Bagasse · CMP pulp · Fiber length

INTRODUCTION

In general, pulp refining two actions simultaneously is done on fibers which include opening each fiber and the fiber layers to increase Elasticity and flexibility is it [1, 2]. In fact, a refinement Type of mechanical treatment is on fiber. Fibers under the influence shear, tensile and compressive forces and the changes that are imposed on them by changing systems vary [3]. The effects of refining on fibers are explained as follows: 1) Fibers could be enlarged [2]. 2) More fiber flexibility. 3) Fibrillation of the secondary wall. 5) Slits in fibers and increase in fine particles with the objective of a desirable formation of paper sheets [4]. Losing initial walls Fibers in refining, create a better situation for flexibility and connection [5]. The objective of this study was to investigating Effect of beating value on Bagasse CMP Pulp Fiber Characteristics.

Experimental

Materials: The depithed bagasse used in this study was collected from a local pulp and paper mill (Pars Paper Co. Haft Tapeh. Iran). Cooking factors in pulping stage were as: cooking temperature 160°C, cooking time 40 min and chemicals (based on Sodium Sulphite) 15%. The PFI Mill (Model of LABTECH (with 2500, 3000, 3500 and 4000 Rpm was used for the refinement. Sampling was made before and after refining. Moreover, Franklin (1954) method [6] was used to measure the dimensions of pulp fibers. After full isolation of fibers on each other 120 fibers were measured for properties of length, general diameters, diameter of cell cavity and thickness of fiber walls in the middle part of fibers. Measurement of fibers dimension was calculated by LEICAQ5000 MC imaging analysis. The averages have been compared applying analysis of variance in random model and Duncan Multiple Range Testing.

RESULTS

Analysis of variance showed the mean fiber length, Fiber diameter, Lumen width, Cell wall thickness before and after refining the period 0, 2500, 3000, 3500 and 4000 revelations, in 95 percent confidence level there is a significant difference (Table 1).

The mean average of measurement results for fiber Length, Fiber diameter, Lumen width and wall thickness and the freeness of pulp before and after refining in 0 rpm (control), 2500, 3000, 3500 and 4000 rpm have been shown in Table 2. According to this table, the values before refining (control) and refining with 4000 rpm have the least and most value of fibers dimensions and rate, respectively.

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Table 1: Variance analysis of specifications of bagasse pulp fibers in different rotations of PFI refiner

Variations sources	Freedom degree	Calculation F fiber Length	Calculation F Fiber diameter	Calculation F Lumen width	Calculation F wall thickness
Treatment	4	60.955*	5.407*	19.991*	7.118*

*Significance in statistical reliability: 95 percent

Table 2: Comparison of mean average of diameters of fibers and freeness of chemical Mechanical pulping in different rotations of PFI refiner

Refining degree	Fiber Length (mm)	Fiber diameter (µ)	Lumen width (µ)	Wall Thickness (µ)	Freeness (CSF)
Control	1.35a*	21.92a	9.66a	5.56a	630
2500	1.17b	19.6b	8.77b	4.72b	468
3000	1.14b	19.31b	8.55bc	4.61b	406
3500	1.02c	17.93c	7.78cd	4.34b	357
4000	0.71d	16.28d	7.19d	3.81c	287

* Superscript letters in the table indicate statistically significant difference and Duncan ranking of the average value of measured property

DISCUSSION AND CONCLUSION

The results of the research showed that by increasing in refining amount, fiber length, fiber diameter, Lumen width, wall thickness and freeness degree of pulp decreases (Molin and Daniel 2004, Rushdan 2003, Tchepel *et al.* 2004,) [5, 7, 8]. Because of refining, Primary wall partially removed and therefore, Secondary wall in direct contact Placed with water and easily absorbs water and is swelling, this, Improve the flexibility of fiber. On the other hand, more of refined, Led to the emergence microfibrils on the surface of fibers, causing an increase in the total surface of refined fibers [2]. But, besides the positive effects, there might be unsuitable effects in the course of refining, including fibers breakage and shortening is due to shear forces. Also, due to refining, percentage of fine in fibers increases and therefore hence the tendency to maintain water increases and freeness of the pulp is reduced [4]. This study showed that as refining increases to 4000 rpm, not only can the fiber will fibril too, but also the fines increased. Therefore, refining should be performed in a way that would leave minimum impacts on fibers and paper strength. Since the best refining is obtained in a freeness level of 300-500 ml CSF is achieved. Thus 3000 rpm, considering the fiber dimensions and freeness of Pulp (406 ml CSF) as revelation optimum refining suggested.

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