Asian Journal of Chemistry Vol. 22, No. 2 (2010), 1051-1054

Anthraquinone Sulphate Chemical Pulping of *Ceiba pentandra*

YOGESH KUMAR WALIA and D.K. GUPTA*
Department of Chemistry, Government Motilal Vigyan Mahavidyalaya, Bhopal-462 008, India
E-mail: walia_yogesh@yahoo.com

Bleachable grade of pulp is produced by sulphate chemical process because reduced pitch troubles with resinuous wood. The stream pollution and air pollution can be minimised by using anthraquinone. In sulphate pulping, the yield and properties of pulp produced are dependent on two sets of variables, with the fibrous raw material and with the pulping operation. The permagnate number and pulp yield are determined by analysis. On addition of anthraquinone in sulphate process, there is no adverse effect but it is helpful in reducing the cost of pulp.

Key Words: Pulping, Anthraquinone, Permagnate number, Pulp yield.

INTRODUCTION

Determination of pulping yield is not a straight forward task. The conversion of wood into pulp is brought mechanically and chemically[1]. In mechanical pulping, the fibres are separated from each other by mechanical forces. Mechanical process is employed in case of poor grade papers which do not have much strength and durability in printing. In chemical pulping, wood pulp fibres are manufactured by chemical dissolving those components, mainly lignin, that keep wood cell together to form the original wood structure[2]. The chemical processes are soda, sulphite and sulphate. In soda process, fragments are treated with sodium hydroxide and heated at a temperature *ca.* 115 ºC. In sulphite process, the wood log is treated with an acid solution consisting of bisulphites and sulphurous acid under high pressure. The Kraft (sulphate) process is the dominant chemical pulping method. It is strong alkaline process[3], in which the active components are the hydroxide and hydrosulfide ions. The cooking chemicals are recovered and regenerated. The Kraft cooking liquor is a mixture of white liquor, water in wood chips, condensed steam and weak black liquor. In hardwood pulping[4] especially, there is a great need for more efficient sulphate pulp washing. Anthraquinone can be use as an additive in sulphate heating to stablize the carbohydrates against alkaline degradation[5]. It is well known that the total pulp yield is related to the Kappa number (K. no.) for Kraft heating constant sulphidity and effective alkali charge[6].

$$\text{Total Yield} = (0.14 \times \text{Kappa no.}) + \text{Const.}$$

Juvekar *et al*.[7] published an empirical method for determination of total pulp yield based on process parameters such as effective alkali and H-factor. This work was undertaken to study the extent of pulp degradation during the different stages of conventional pulping processes. The stream pollution and air pollution can be minimized by using anthraquinone.

EXPERIMENTAL

The dried debarked logs of *Ceiba pentandra* converted into chips[8]. The chips were screened and allowed to pass through 22 mm diameter holes and those retained on 5 mm diameter holes were collected for Kraft treatment and added 0.05 % anthraquinone is mixed. Cooking temperature is kept at 165 ºC and treatment time 2, 1.5, 1 and 0.5 h are fixed.

Determination of permagnate number: 1 g of oven dried pulp was taken in a beaker containing 1200 mL of distilled water and it was stirred to get homogenous solution. 40 mL each of 0.1 N $KMnO_4$ and 4 N H_2SO_4 was added to it and was allowed to stir for exactly 5 min. Then KI solution was added to stop the reaction. The obtained solution was titrated against 0.1N hypo solution using starch as indicator. K. No. = 40 mL hypo consumed.

Determination of pulp yield: 100 g chips of *Ceiba pentandra* on oven dry basis was taken in a perforated yield box and was placed in the middle of digester while loading the digester. At the end of cooking, chips were taken out of yield box and after washing, disintegration and screening dried in a ventillated oven at 100 ± 5 ºC overnight. The dried samples were weighed and yield was determined on original weight of chips taken.

RESULTS AND DISCUSSION

The results of permagnate number of pulp and pulp yield of *Ceiba pentandra* are recorded in Table-1. The graphs are plotted on the basis of the data presented in the Table-1 and shown in Figs. 1-4. From the table and figures it is evident that when the pulp of *Ceiba pentandra* is treated with 15 % active alkali without the addition of anthraquinone for 2 h at the temperature 165 ºC, the K. no. is 21.0 and pulp yield obtained in percentage was 55.4. But on adding the 0.05 % anthraquinone and with reducing the active alkali percentage from 15 to 11, the K. no. and pulp yield is increased (Figs. 1and 2). It is also clearly shown in Figs. 3 and 4 that when the active alkali percentage was 15, the temperature was 165 ºC, anthraquinone percentage 0.5 kept constant and on reducing treatment time from 2 to 0.5 h, the K. no. and pulp yield increases.

TABLE-1
ANTHRAQUINONE SULPHATE PULPING OF *Ceiba pentandra* AT 165 ºC

Heating number	Active alkali (%)	Anthraquinone (%)	Time (h)	Permagnate number (K. No.)	Total pulp yield (%)
1	15	0.00	2.0	21.0	55.4
2	15	0.05	2.0	17.8	54.1
3	15	0.05	2.0	18.5	55.2
4	15	0.05	2.0	19.7	56.1
5	15	0.05	2.0	20.6	57.0
6	15	0.05	2.0	21.8	57.8
7	15	0.05	1.5	19.0	55.6
8	15	0.05	1.0	20.9	56.2
9	15	0.05	0.5	21.5	56.9

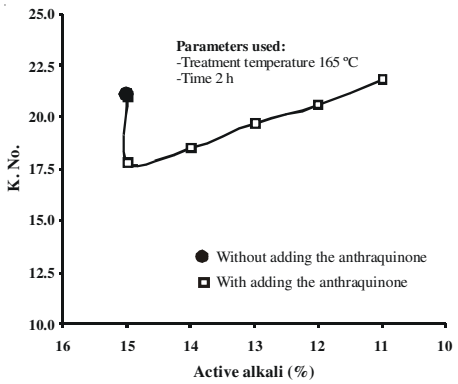

Fig. 1. Effect of anthraquinone on active alkali and K. No. of *Ceiba pentandra*

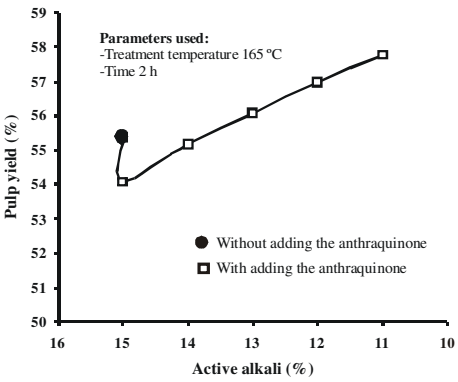

Fig. 2. Effect of anthraquinone on active alkali and pulp yield of *Ceiba pentandra*

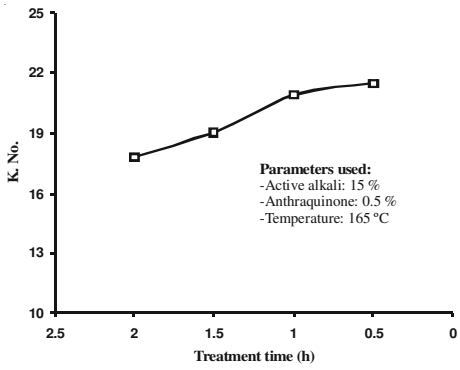

Fig. 3. Effect of anthraquinone on treatment time and K. No. of *Ceiba pentandra*

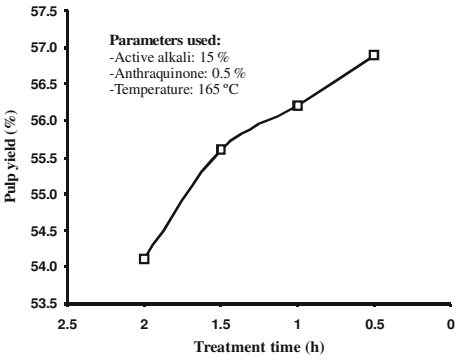

Fig. 4. Effect of anthraquinone on treatment time and pulp yield of *Ceiba pentandra*

From the discussion of the results obtained, it is observed that the study of sulphate chemical pulping of *Ceiba pentandra* that on addition of a little amount of anthraquinone, the K. no. and quantity of pulp yield increases and consumption of alkali reduces[9]. It is also founds that by adding anthraquinone, the treatment time reduces but pulp yield not affected or may be increased[10]. In this way it is helpful in reducing the cost of pulp.

ACKNOWLEDGEMENTS

The authors acknowledged the necessary support provided by Dr. Sarita Shrivastava, Head and Dr. Alka Pradhan, Department of Chemistry, Government M.V.M., Bhopal .

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(*Received*: 10 December 2008; *Accepted*: 12 October 2009) AJC-7946