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ACCELERATING THE DELIGNIFICATION OF *IPOMOEA CARNEA* JACQ BY USING CHEMICAL ADDITIVES

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ABSTRACT

Laboratory scale alkaline pulping studies were carried out by the addition of different quinone dosages. It was observed that varied physical properties were seen by the addition of different anthraquinone and other quinone additives. In this study, anthraquinone was more effective in improving the yield. Chemical additives react with lignin during the process of delignification and thus, accelerate delignification and stabilize carbohydrate to give higher pulp yield.

Key words: Anthraquinone, Delingnification, Alkaline pulping, Additives, *Ipomoea*.

INTRODUCTION

The world paper consumption is increasing continuously. It has been estimated that during the next fifteen to twenty years, it will be doubled and tripled in many developing countries. Globally, the forest resources are however diminishing, while the paper demand is increasing[1, 2]. To conserve wood resources, non-wood fiber plants can be substituted for pulping. The increasing scarcity of fibrous raw material for pulp and papermaking has directed the attention of paper technologist to search alternative pulping process other than Kraft process. Although the Kraft process has several well established advantages over other pulping process including unmatched product quality, high chemical, energy efficiency and the ability to pulp almost any wood species. Pulping additives such as anthraquinone and its derivatives have gained worldwide importance for improving the pulp yield in soda and Kraft pulping process without addition to the cost of plants and machinery[3-5].

Anthraquinone has a marked catalytic effect on the delignification in both; soda and Kraft pulping of soft wood and hard woods. Many authors have examined aspects of additives performance and its mechanism of action[6-14]. It has been found that anthraquinone addition enhances the rate of delignification stabilizing carbohydrates,

which results in increased pulp yield. Anthraquinone, that is 0.05-0.1% on wood basis, is effective in enhancing the rate of delignification and achieving higher yields.

EXPERIMENTAL

Ipomoea carnea Jacq was collected. The log samples were cleaned. The dried stems were chipped on the pilot plant; the chip was dried in air and allowed to have uniform moisture content. The screened chips were used in the experimental work. About 300 g chips were cooked using various quinone additives under following condition:

Total active alkali: 16-19%

Raw material to liquor ratio: 1 : 4

Temperature of cooking: 170^{o}C

Chemical additives used: Anthraquinone, Anthrone, 2,6-dichloroquinone-4-chlorimide and 8-Hydroxyquinoline.

All pulping experiments were carried out in stow sets apparatus autoclave bomb digester, which comprises of six stainless steel digester, each of 2.5 litres capacity, rotating in the bath .The pulp thus obtained were screened in a vibratory screen having 35/100 mm slit width and the rejects were collected.

The total unbleached pulp yield was determined as:

Kappa Number –Determined as per Tappi methods.

Bleaching-Pulps were bleached using CEHH sequence

Pulp evaluation: Screened pulps were beaten in PFI mill at a fixed resolution (600). Standard sheets of about 60 gsm were made in sheet making machine at 27 ± 10^{O}C and 65 + 2 RH and then these dried sheets were tested for various strength properties as per ISO methods.

Brightness: Brightness of pulp was measured under standard condition of ISO methods 2470 using elreph 2000 data colour brightness tester.

Table 1. Physical properties of unbleached pulp

Pulping	Cooking chemical as NaOH	Freeness (CSF)	Properties						
			Basic weight	Tensile index	Tensile strength	Tear index	Burst index	Double fold	Kappa number
Soda pulping	15.6	290	66.34	52.51	4.93	7.02	3.06	19	43
Soda AQ	15.6	290	65.21	55.43	4.57	7.36	3.77	55	38
Soda pulping	16.8	290	65.67	49.96	4.57	7.31	3.06	32	39
Soda AQ	16.8	290	65.69	58.29	5.10	7.71	4.22	66	33
Soda pulping	17.1	290	64.00	43.30	4.28	3.28	3.00	23	35
Soda AQ	17.1	290	68.22	54.82	4.67	5.90	3.62	47	26
Soda pulping	18	290	65.67	43.30	4.27	5.46	2.33	15	24
Soda AQ	18	290	65.64	46.60	4.20	6.61	2.53	26	20

Table 2. Bleaching of pulp prepared from soda additive pulping

Cooking	Unbleached screened pulp yield (%)	Kappa number	Sequence CEHH (%)	Bleached pulp yield (%)	Brightness (%)	Post color number	Viscosity (CPS)	Degree of polymerization
Soda pulping	40.10	33.0	C = 6.6 E = 1.25 H = 1.25 H = 0.5	30.00	68.40	1.70	4.40	607.0
Soda AQ pulping	45.00	24.2	C = 4.8 E = 1.25 H = 1.25 H = 0.5	40.80	79.80	1.25	5.00	645.0
Soda anthrone	43.00	29.3	C = 5.8 E = 1.25 H = 1.25 H = 0.5	38.50	74.20	1.38	4.79	651.0
Soda 2.6-dichloro quinoline- 4-chlorimide	43.50	31.0	C = 6.4 E = 1.25 H = 1.25 H = 0.5	37.80	71.40	1.70	4.78	629.7
Soda 8 hydroxy quinoline	40.20	32.0	C = 6.6 E = 1.25 H = 1.25 H = 0.5	36.90	67.20	1.62	4.78	632.8

Table 3. Physical properties of bleached pulp prepared from soda additive pulping

Pulping	Freeness (CSF)	Density	Burst index	Tensile index	Tensile strength	Tear index
Soda pulping	305	0.66	2.8	45.5	2.6	6.25
Soda AQ pulping	260	0.73	3.00	49.0	4.0	6.5
Soda anthrone pulping	240	0.73	2.5	43.0	3.9	6.5
Soda 2,6-dichloroquinoline-4-chlorimide pulping	320	0.66	3.00	51.5	3.7	6.5
Soda 8-hydroxy quinoline pulping	320	0.66	2.8	47.0	3.5	6.7

RESULTS AND DISCUSSION

Studies carried on unbleached pulp at 15.6, 16.8, 17.1 and 18% on soda and soda anthraquinone pulping showed that parameters such as basic weight, tensile index, burst index and double fold increased in soda AQ with respect to soda pulping. Bleaching in which chlorine (6%), alkali (1.5%) and hypo (1.25%) was found to be good for pulp. Additives used are anthraquinone, anthrone, 2,6-dichloroquinone-4-chlorimde and 8-Hydroxyquinline.It can be revealed that consumption of bleach chemical was lowest for pulp prepared from soda anthraquinone because of its lower kappa number.

The order of consumption of bleach chemical with different additives was anthraquinone > anthrone > 2,6-dichloroquinone-4-chlorimide > 8-hydroxyquinoline. Maximum brightness was found in soda AQ while post colour number was lowest in case of soda AQ. Anthraquinone used less amount of bleaching chemical; thus, pulp prepared from soda AQ pulping has high viscosity and degree of polymerisation. Bleached pulps were beaten in 6000 revolution and hand sheets were studied for physical properties. It is clear from the table that the freeness of soda AQ and soda anthrone was 20 and 40 CSF. It was found that rate of delignification was higher with 0.1% of each additives. It is clear from the table that the freeness of soda AQ and soda anthrone was 20 and 40 CSF less than that of soda pulping, but soda 2,6-dichloroquinone-4-chlorimde and soda 8-hydroxyquinoline was 15CSF higher density of soda, soda 2,6-dichloroquinone-4-chlorimde and soda, 8-hydroxy quinoline. Burst indexes of soda, soda 2,6-

dichloroquinone-4-chlorimde and 8-hydroxy quinoline was more. Tensile index soda AQ was higher than soda pulping, soda anthrone and soda 8-hydroxyquinoline but less than soda 2,6-dichloroquinone-4-chlorimde. Tensile strength and tear index was higher in soda AQ pulp as compared to that of other pulping.

CONCLUSION

The order of effectiveness on physical strength properties was studied. It was concluded that order of various additives was found to be Anthraquinone >Anthrone >2,6-dichloroquinone-4-chlorimde > 8-Hydroxyquinoline.

Use of chemical additive shows higher strength properties and higher brightness in comparison to soda pulping, which may be due to more solubilization of lignin and stabilization of polysaccharide even at higher pulp yield. Use of chemical additive in pulping for improving the pulp yield without impairment in strength properties and bleachabilty showed modification of degraded lignin during pulping to produce compounds of anthraquinone, which is very effective in the delignification and carbohydrate stabilization resulting in the increased pulp yield.

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