Novel Cooking Aid and Delignification Catalyst for Pulp Manufacturing using Various Agro Residues

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ABSTRACT

Novel cooking aid and delignification catalyst have been developed which are applicable to various raw materials such as bagasse, wheat straw, bamboo and hard wood. Results of pilot plant and plant trials are given. The effects of catalyst on reduction in Kappa no. on bamboo+ hard wood and wheat straw are discussed here.

INTRODUCTION

Current Economic situation which is not very encouraging to industry and particularly to the Paper industry prompted our R&D Dept. to focus on cooking additive which contributes to the process of Paper manufacturing. We selected the delignification process for further studies as this is the process which if improved, can greatly improve quality of the pulp and also reduce chemical consumption. Delignification process involves removal of lignin from the raw material and greater the efficiency of this process the better it is for the company to implement cost saving measures.

EXPERIMENTAL

Various cooking aids available in the industry including Anthraquinone were studied. An efficient cooking aid helps the process of delignification for better and economical results.Various raw materials like Bagasse, Wheat straw, Bamboo and Hardwood were studied using our product as a cooking aid which is a combination of modified anthraquinone and inorganic salt.

RESULTS AND DISCUSSION

It was observed that the penetration power of anthraquinone in the raw materials was enhanced. During the process Kappa Number was targeted as a parameter.

Cost reduction in pulping process was studied. Cooking Chemicals and Bleaching Chemicals required were reduced keeping Kappa Number in mind. Reduction in Kappa Number and cooking chemicals with better yield of pulp was notical in Laboratory, Pilot as well as Plant Scale. This helped to reduced chemical treatment during effluent treatment. It was also observed that the requirement of the catalyst was less compared to that of anthraquinone, if used alone.

On an average, 0.1% catalyst gives better results than 0.5% of AQ. Experimental details are given to give an idea of utility of catalyst.

Dosages

The dose of Navdelignin-05B has been optimized to 0.02% (200g per tonne of raw material on OD basis) after a series of trials from 0.01% to 0.1%. It was observed that 0.02% is the optimum dose technically and economically for bagasse as raw material. As for other raw materials like Hard wood, bamboo, Reed the dosages are 0.1% on OD basis of raw material. (It will replace Anthraquinone and dose is 20% as that of anthraquinone).

The effectiveness of Navdelignin-05B has been proved on various pulp raw materials like Bagasse, wheat straw, bamboo and hard wood. Development work has been carried out with kappa number as targeted parameter, as kappa number reflect the quality of pulp in terms of yield, fibre characteristics, bleachability etc. Attention was also given to the cost reduction of pulping in terms of reduction of cooking chemicals and bleaching chemicals. Reduction in kappa number and cooking chemical input has been

Table 1. Results of Trials with Bagasse as raw material

Raw material	Bagasse-Depithed 400g (10.0% moisture) bone weight: 360g
Cooking chemical	NaOH
Bath ratio	1:3
Cooking temperature	150°C ± 2°C
Cooking pressure	5-6 kg/cm²
Duration of cooking	150 minutes

Cooking Chemical % (weight)	Description	Blank	Anthraquinone 0.05%	Navdelignin-05B 0.02%
140% (50.4g)	Kappa number	16.3	15.2	13.2
	Residual alkali (gpl)	3.54	4.8	4.52
	pH	10.8	11.5	11.2
130% (46.8g)	Kappa number	17.4	16.04	13.1
	Residual alkali (gpl)	3.4	4.0	4.3
	pH	10.7	11.2	11.42
12% (43.2g)	Kappa number	19.5	16.6	15.5
	Residual alkali (gpl)	3.0	3.58	3.0
	pH	10.4	10.9	10.7

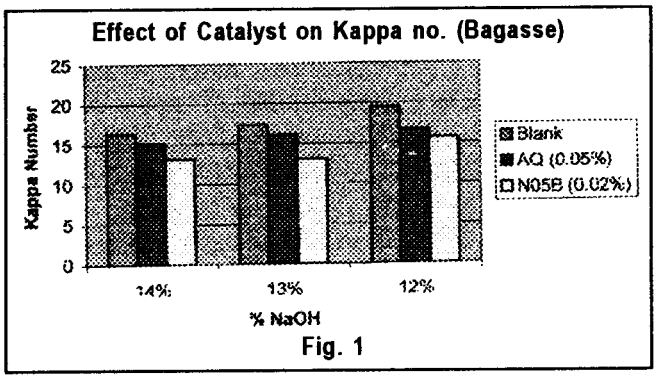

Fig. 1

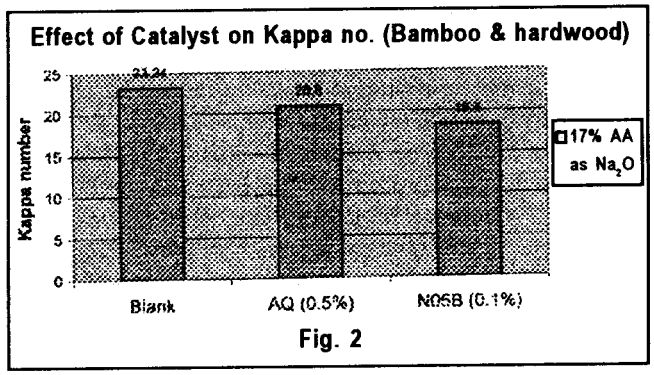

Fig. 2

Table 2. Results Trials with Bamboo & hardwood as raw material

Raw material	Bamboo and Hardwood (70:30) 330g (10.0% moisture) bone weight: 300g
Cooking chemical	17% as Na_2O 58% Causticity 15% Sulphidity (NaOH=56g) [Na_2S (58% pure)= 17.2g]
Bath ratio	1:3
Cooking temperature	165°C ± 2°C
Cooking pressure	8 - 8.5 kg/cm²
Duration of cooking	6 hours (lead to lead)

Contents	Blank	Anthraquinone 0.5%	Navdelignin-05B 0.1%
Kappa no.	23.24	20.8	18.4
Residual alkali (gpl)	4.10	3.28	3.95
pH	12.0	11.7	11.8

Table 3. Results Trials with Wheat straw as raw material

Raw material	Wheat straw-Depithed 1.5 Kg Bone wt. (9.7% moisture)
Cooking chemical	NaOH
Bath ratio	1:5
Cooking temperature	150°C ± 2°C
Cooking pressure	5 - 6 kg/cm²
Duration of cooking	90 minutes (Upto 160°C) 120 minutes (at 160°C)

Description	Case A Blank 15% NaOH	Case B 15% 15% NaOH 0.02% Nav-05B	Case C 14% 14% NaOH 0 02% Nav-05B
Unbleached pulp			
Kappa number	18.9	15.4	16.8
Pulp yield (%)	50	51.3	51.6
Black liquor			
Residual alkali (gpl)	1.92	3.52	2.88
pH	11.2	11.8	11.7
Bleached pulp			
Total Cl_2 consumption (Bleached pulp basis)	9.1	6.6	7.52
Brightness (%)	83.4	83.5	83.1

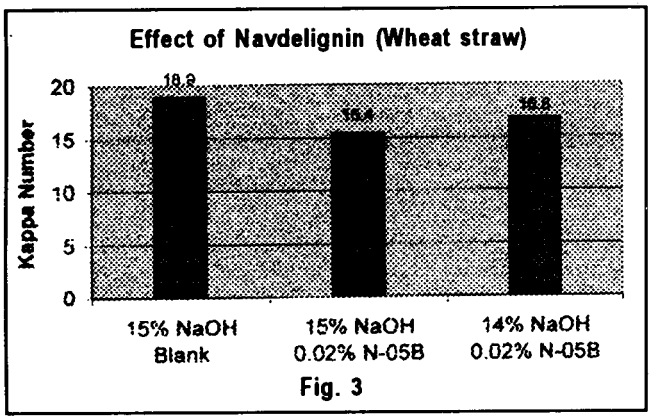

Fig. 3

achieved in Laboratory, pilot as well as at the plant scale.

The results are shown in Tables 1-3 and Fig. 1-3.

Observation (Laboratory observation)

Kappa no. maintained close to the standard though caustic dosages are reduced by 2% i.e. from 14% to 12. (Laboratory evaluation).

Table 2 (RM Bamboo and Hardwood 70:30) Observation (Laboratory Observation)

It is observed that @ 0.1% Navdelignin-05B gives better K value than of 0.5% of Anthraquinone.

Table 3 (RM-Wheat Straw)

Observation (Plant trials)

1. Pulp yield in creased by 1.1% and 1.5% in case of B and C as compared to case A (blank).

2. Pulp yield increased by 1.1% and 1.5% in case of B and C as compared to case A (blank).

3. Kappa number decreased by 3.4 number and 2.1 number in case B and case C as compared to case A (blank).

4. Chlorine consumption decreased by 2.5% and 1.58% on OD of bleached pulp basis in case of B and C respectively as compared to case A (blank) at same brightness level.

CONCLUSION

From all the above it can be concluded that the product Navdelignin-05B is effective and efficient than the conventional cooking aid on the raw materials like bagasse, wheat straw, bamboo and hardwood. Continued research is going on to evaluate the action of the product on other raw materials and other combinations.