

Two Stage Oxygen For Bleaching Dissolving Grade Pulp

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The mill has modified the bleaching sequence incorporating two stage oxygen treatment for improved environmental performance and improved product quality. The new bleaching sequence has reduced the effluent colour, reduced bleaching chemicals, enhanced pulp brightness, improved pulp viscosity control and reduced power consumption in biological reactor. This paper describes the approach and benefits of incorporating two stage oxygen bleaching in dissolving grade pulp mill.

INTRODUCTION

Harihar Polyfibers, a unit of Grasim Industries Limited is located at Kumarapatnam in Karnataka. The mill was set up in 1972 and is presently producing 72,000 tpa dissolving grade pulp employing pre-hydrolysis kraft process using Eucalyptus & other mixed hardwood as raw material. Dissolving grade pulp is processed in viscose staple fiber plants finding the end use in textiles.

The mill has centered its business and operational philosophy around the twin principles of resource conservation and pollution prevention. Various cleaner technologies are incorporated minimizing the effluent generation, trimming energy requirement, optimizing the chemical consumption and enhancing the product quality.

BACKGROUND

Unlike in paper grade, the dissolving grade pulp is cooked to a low kappa number of 10 +/-1 and viscosity level of 32 +/-5 cP. The mill was operated initially with conventional bleaching sequence CEHD producing pulp of 87.0% ISO brightness. The bleaching sequence was modified to CEHED in 1987 incorporating 2nd alkali extraction stage and increased the pulp brightness

to 88.0% ISO. In 1990, the mill introduced oxygen bleaching for the first time in India and adopted CE/OHED sequence to reduce the bleaching consumption, improve the pulp brightness and reduce the effluent load. Pulp brightness increased to 89.5 % ISO and COD of waste water from bleaching reduced by 25%. Further, to meet the requirement of higher brightness and whiteness, bleaching sequence was modified to CE/OHEDH with introduction of second hypo in 1998, increasing the pulp brightness to 90.0 %ISO. Though continuous changes in bleaching sequence could meet the requirement of higher brightness but introduction of hypo in the last stage resulted in poor control of pulp viscosity affecting fibre plant operations. To improve the pulp quality the mill examined the possibility of incorporating oxygen delignification (after brown stock washing), ozone bleaching and hydrogen peroxide. These options not found feasible due to limitations in recovery plant capacity and high cost with ozone & peroxide bleaching.

In this context the mill worked on alternate bleaching sequence to improve the pulp quality and to reduce effluent load.

Pilot Scale Pulp Bleaching Trials

Various pilot scale trials were conducted to improve the bleaching sequence, This includes peroxide at dioxide stage & double oxygen at first

alkali extraction (E1) stage, hydrogen peroxide at second alkali extraction (E2) stage, double dioxide treatment, higher oxygen at first alkali extraction (E1) stage, two stage hypo at first alkali extraction (E1) stage, bleach liquor (combination of caustic and hydrogen peroxide) at first alkali extraction (E1) stage, two stage oxygen at first alkali extraction (E1) stage. Each sequence was studied for its potential in reducing the bleach effluent colour, bleaching chemicals, effect on pulp viscosity and pulp brightness. The trial results are tabulated in Table 1:

Two stage oxygen bleaching was found promising in reducing effluent colour increasing the pulp brightness and reducing pulp viscosity variation.

Plant Scale Implementation

Pilot scale trials of two stage oxygen was scaled up for implementation in plant. The existing bleaching sequence was modified to CE/OoHED in 2000, incorporating medium consistency pump, vacuum pump, motors, necessary piping & valves and controls & instrumentation.

The flow diagram of two stage oxygen bleaching is depicted in Fig 1.

Various teething problems such as cellulose degradation due to additional reaction time, control of viscosity due to elimination of second hypo was experienced. The process operations were strengthened with revisit of pilot scale trials and fixing

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Table 1**Result of Pilot Scale bleaching trials**

Sl No.	Bleaching sequence	Reduction in bleach effluent colour, Pt Co			Increase in Pulp brightness, %ISO			Additional Cost Rs/t pulp	Remarks
		From	To	% Redn	From	To	Gain units		
1.	CE/OoHEDP	800	744	7.0	90.0	91.1	1.1	164	High Operating cost
2.	CE/OH(E+P)D	800	680	15.0	90.0	91.0	1.0	170	High Operating cost
3.	CE/OHEDD	800	744	7.0	90.0	90.2	0.2	Nil	No significant reduction in colour & gain in pulp brightness
4.	CE/OHED (Higher oxygen)	800	740	7.5	90.0	90.0	-	Nil	No change in pulp brightness and no significant reduction in colour
5.	CE/(O+H)HED	800	640	20.0	90.0	90.3	0.3	20	Drop in viscosity, No significant gain in brightness
6.	CE/(O+H)HED (Bleach Liquor with higher oxygen)	800	600	25.0	90.0	90.5	0.5	99	High operating cost
7.	CE/OoHED (Two stage oxygen)	800	550	31.3	90.0	91.1	1.1	Nil (Gain of Rs 19.4/t pulp)	Significant reduction in colour Improved pulp brightness Stable viscosity Reduced operating cost

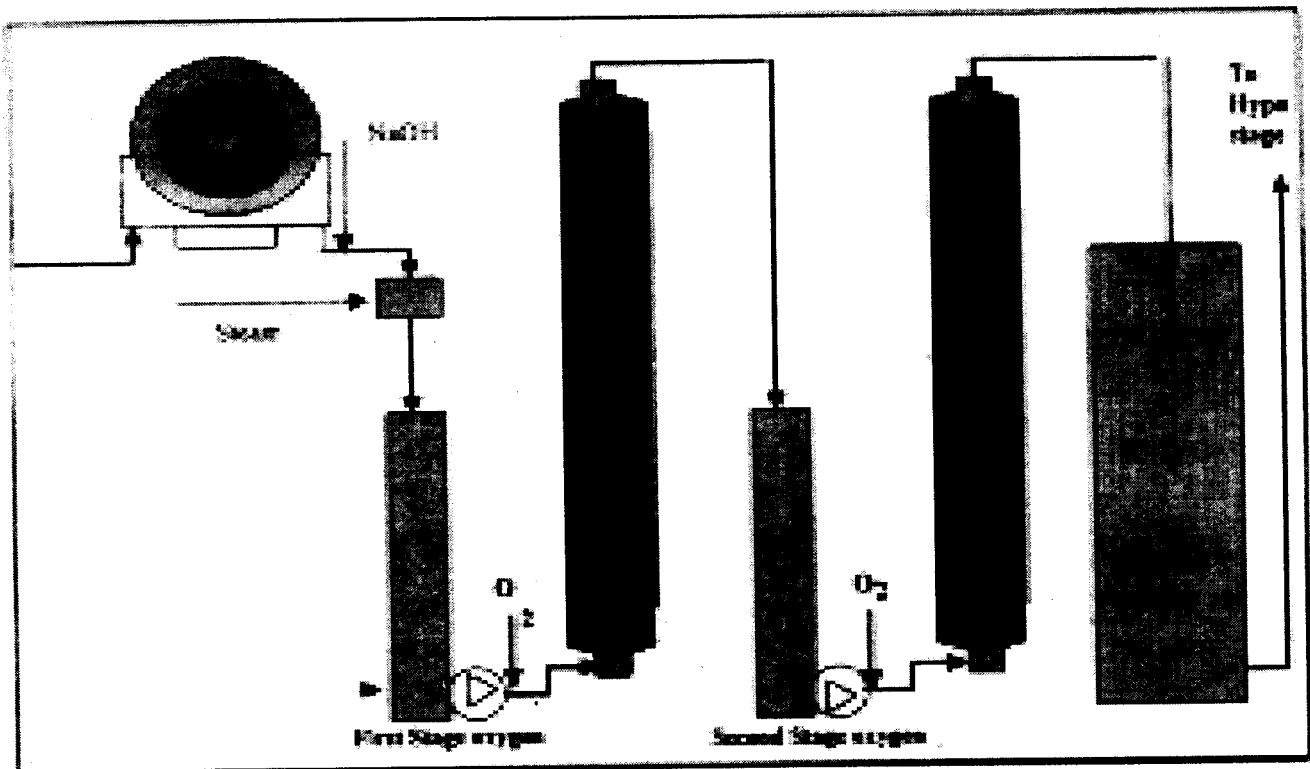


Fig. 1 Flow diagram of two stage oxygen bleaching

the parameters with series of run on the plant scale. The modified two-stage bleaching sequence CE/OoHED was regularized and is in successful operation.

Benefits

- Effluent colour at first alkali extraction (E1) stage in bleaching reduced by 40%
- Bleach effluent colour reduced by 25%.
- Final effluent colour reduced by 15%.
- With reduced effluent colour, the

Table 3 Savings

Type	Unit	Qty/Day	Rate, Rs/ unit	Annual saving Rs lac
Caustic	kgs	498	16.968	29.8
Chlorine	kgs	239	3.213	2.7
Power	kwh	471	2.5	4.2
Additional Oxygen	kgs	698	7.647	-18.8
Total				17.9

number of aerators running in biological reactor reduced resulting in power saving.

- Second hypo stage was eliminated reducing caustic and chlorine consumption.

- Increase in pulp brightness with progressive improvement in viscosity facilitated the mill to increase the pulp viscosity level from 11-13 Cp to 12-14 Cp as per customer requirement.

Economics

- Investment: Rs 30.0 lac
- Savings (see table 3)
- Pay back : 2 years

Table 2 Results of two stage oxygen bleaching

Parameter	Unit	Single stage oxygen CE/OHEDH	Two stage oxygen CE/OoHED
Bleaching sequence	-	CE/OHEDH	CE/OoHED
Pulp quality			
-Brightness	%ISO	90.0	91.0
-Viscosity	cp	12+/-3	13+/-1
-Solubility in 7.14%NaOH	%	9.3	8.4
Effluent Colour			
1 st Alkali Extraction stage	Pt.Co.	5665	3400
% Reduction	%	-	40.0
Bleach effluent colour	Pt.Co.	800	600.0
% Reduction	%	-	25.0

CONCLUSION

The mill has successfully developed and implemented two stage oxygen bleaching a cost effective cleaner process to improve pulp quality and to reduce effluent colour at source. Thus the mill could demonstrate its twin objectives "resource conservation and pollution prevention go hand in hand"