CPM Initiatives Towards CREP Compliance

K Radhamohan, S D Gunjikar, S Goswami, N K Agarwal and B P Biyani

Central Pulp Mills a unit of JK Paper Ltd situated in Fort Songadh, Dist: Surat of Gujarat is a large integrated Pulp and Paper Mill having a capacity of 53,000 TPA of Writing, Printing and Speciality Papers. Bamboo and Mixed hardwoods are the major raw materials used. The mill adopts kraft-pulping process and bleaches the pulp to a brightness level of 81±2% ISO in the conventional CEpHH bleach sequence.

In compliance with the Corporate Responsibility for Environmental Protection, the mill has taken several initiatives in areas like up-gradation of technology, water conservation, wastewater discharge etc. In this direction the mill installed a new screening system, an Oxygen Delignification Plant alongwith white liquor oxidation plant in the Pulp Mill to reduce AOX generation. The mill has also gone for reinforcement of Alkali Extraction (Ep) stage of bleaching with oxygen, making it Eop to further reduce AOX generation.

PREAMBLE

Traditionally paper industry is a water intensive industry and most of the mills are located near rivers and in some cases the treated effluents from the mills are let out into those rivers. Paper industry is also known as a highly polluting industry due to the heavy pollution load emanating from the pulping and bleaching operations.

Growing environmental awareness, Government regulations becoming more and more stringent day by day and the Corporate Responsibility for Environmental Protection under taken by the industry had made the mills adopt modern technologies for cleaner production.

Global scenario indicates that paper industry is moving away from the chlorine bleaching which had been so far the cheapest and most widely used bleaching chemical. The shift is necessitated not only to minimise / eliminate the generation of hazardous / toxic materials like AOX but also for enabling recycling of bleach plant effluents. It had been widely accepted that AOX generation is proportional to the quantity of chlorine consumed particularly as elemental chlorine. Many mills have gone for partial substitution of chlorine with chlorine dioxide in the 1st stage of bleaching. Another development in reducing the elemental chlorine consumption is Oxygen Delignification of unbleached pulp before bleaching.

J.K. Paper Limited, Unit : Central Pulp Mills, Fort Songadh, Dist: Surat, Gujarat - 394 660

CPM SCENARIO:

BRIEF DESCRIPTION OF THE PULPING AND BLEACHING PROCESSES:

In Central Pulp Mills, a unit of JK Paper Ltd, kraft pulping is adopted and the raw material mix is 70% Bamboo and 30% Hardwood. Bamboo comprises of Dandra Calamus Strictus and Bambusa Arundenacia. Hardwoods are mainly Eucalyptus Hybrid, Leucanca Leucoephale, Casurina Equisitifolia and Acacia Nilotica. The accepted chip size for pulping is -28 mm and +4 mm. Mixed cooking is practiced in the mill. Chips are washed and stored in silo from where they go to digester house.

Chips of Bamboo and wood together are cooked in five stationary vertical digesters by indirect heating. Active alkali is used between 18 to 20% as Na_2O on chips and a bath ratio of 1: 3.4, is maintained. Sulphidity of white liquor is maintained between 18+/- 2%. Steaming is done for 3 hrs and cooking for 2 hrs, temperature is maintained at 165°C. A DCS is installed to control the 'H' factor, which is normally maintained at 2000. After cooking chips are blown to a blow tank from where pulp is passed through Johnsson knotters to separate the knots. The pulp is then washed in a three stage brown stock washing plant. Kappa No. of 22+/-2 is maintained for unbleached pulp at the end of three stage washing. The unbleached pulp is then screened and cleaned in 3 stage centrifugal screens and three-stage centri-cleaner system. Conventional CEopHH bleaching is carried out and a pulp brightness of 81±2% ISO is maintained for consumption in Paper Machines.

To comply with CREP requirements, the mill has taken the following initiatives.

Up-gradation of technology, equipments, process control:

a. Installation of 4th washer:

A fourth brown stock washer was installed in the brown stock washing section of the mill to reduce black liquor carry over to the bleach plant and thus reduce the elemental chlorine consumption and thus the generation of AOX.

New Chemical Recovery Boiler Installation:

A new Soda Recovery Boiler was installed for dual purpose, the first being maintaining of lower Kappa No. i.e. around 20 as against the earlier 22 ± 2. This is mainly intended to reduce the AOX generation. The other reason was to increase the black liquor solids handling capacity to cope with higher pulp production. Both the objectives could be achieved after the installation of new recovery boiler. The new Soda Recovery boiler has a black liquor solids handling capacity of 335 tn/ day and a steam generating capacity of 30T/hr at 42 Kg/cm^2 pressure and 405 ± 5^0C temperature. The boiler is equipped with DCS control system. It has a three-tier air distribution system. After the installation of the new recovery boiler it became possible to maintain Kappa No of washed pulp at 20 ± 2 level thus there had been a proportionate reduction in the elemental chlorine consumption.

Computerisation of Digester House Operations:

The digester house operations were computerized with DCS control. This is based on 'H' factor control. The chips charged to the digester are weighed by means of belt weight-o-meter. A moisture meter installed above the chips feed conveyor senses the moisture content of the chips and feeds the data to the computer. Computer based on the lab analysis of white liquor controls the charge of white liquor to the digester. The pre fed bath ratio to the computer computes the black liquor volume to be added to maintain the bath ratio and controls it. The pre programmed H factor control system computes the H factor taking into account the time and temperature in the cooking and controls the H factor perfectly. Barring wide variations in the raw material the H Factor control system works well to maintain the targeted Kappa No.

Oxygen Delignification plant Installation:

Process changes made and new equipment installed:

A delta knotter was installed ahead of the old Johnsson knotters. The old centrifugal screens and centri-cleaners were discarded and a new three-stage pressure screening system was installed.

The new double stage Oxygen Delignification Plant (ODL Plant) consists of a twin roll press and a chemical mixer, two reactors in series where pulp reacts with oxygen, a blow tank, and two washers in series for post ODL washing of the pulp. For the ODL plant an oxygen generation plant and a white liquor oxidation plant are also installed.

Pulp from Digester House blow tank undergoes hot screening in Delta knotter, accepts of Delta knotter go to the three stage brown stock washing unit. The rejects go to regular Johnsson knotters. Accepts of the Johnsson knotters go to Brown Stock Washers and rejected knots are taken to knotter tank from where they are fed back to digester.

After the three-stage washing, pulp is taken to a chest from where it is pumped to a three-stage pressure screening system. The rejects from the tertiary screen are processed in a screw press and are handled separately. The accepted pulp of primary screen is taken to a twin roll press where the consistency of pulp is increased to 25 to 30%. It is then diluted to 11 to 12% consistency with post-ODL washer filtrate and oxidized white liquor and then taken to S Mixer, where oxygen is injected. The mixture enters the 1st oxygen reaction tower from the bottom. A pressure of 7.5 kg/cm^2 and a temperature of 85^{0}C are maintained in the reactor. A reaction time of 30 minutes is maintained. From the 1st reaction tower pulp is pumped to the bottom of 2nd reaction tower by means of a M.C. pump. Steam is also injected to maintain a temperature of 95^{0}C and a reaction time of 60 minutes is given. There is a provision for oxygen injection in this stage also. Pulp enters the blow tank after the 2nd reactor, from where it is washed in two stage drum washers. The washed pulp is then taken to a tower and then washed with cold water in deckers to reduce the temperature of pulp. The pulp is then bleached in the regular bleach plant. The oxidized white liquor consumption and oxygen consumption are 18 kg and 22 kg/Tn of pulp respectively. Kappa No. of pulp on the 3rd Brown Stock washer is 21 - 22, after the twin roll press is in 20 - 21 range. After Oxygen Delignification it is in 11 - 12 range. Pulp brightness after oxygen delignification is in 29 - 32% ISO range.

Oxygen required for the plant is produced at site. The plant consists of air compressors and molecular sieves to separate Oxygen from Nitrogen. The plant is designed for 250 kg/hr capacity which meets the requirement of not only the Oxygen Delignification Plant, but also for reinforcing the alkali extraction stage in bleach plant which has been modified from Ep stage to Eop stage. The consumption of oxygen is 5 to 6 kg/Tn of pulp in the extraction stage.

The process flow diagram is given in fig-1.

The process flow diagram of white liquor oxidation Plant is given in fig - 2.

New Screening and ODL Plant were commissioned in November 2005 and were stabilized in December 2005.

Over the past ten months of operation several trial and experimentation work was carried out to find the optimum plant operating conditions.

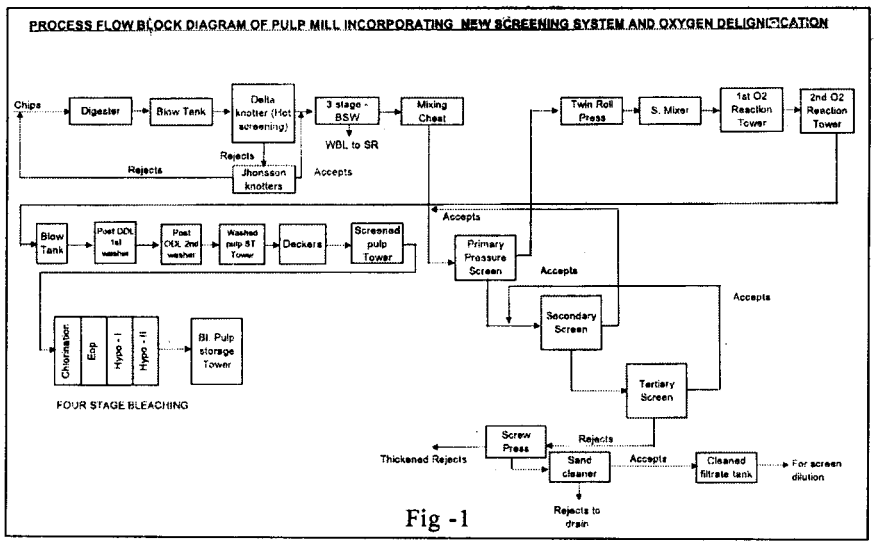

Fig -1

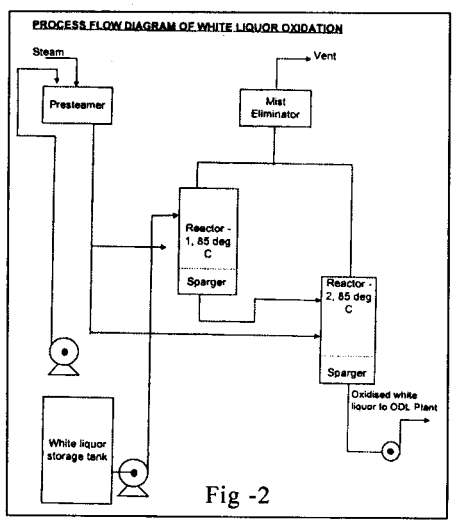

Fig -2

Following observations were made during the last ten months of operation of ODL plant.

1. A drop of about 1 to 1.5 units in kappa No. could be achieved across the new screening system. The pulp was found to be better in quality in terms of reduced shives content and better cleanliness.
2. A reduction of 45% in kappa No. is achieved across the Oxygen Delignification Plant i.e. from 20 to 11.
3. The brightness of pulp after oxygen delignification is in 29 to 32% ISO range.
4. Oxygen consumption is 18 kg/Tn of pulp.
5. About 28 to 30% reduction in the chlorine consumption could be noticed for maintaining a pulp brightness of 83 ±1% ISO which is about 2 points higher than the earlier 81% ISO.
6. The strength properties of pulp at 83% brightness were found comparable to the strength properties of pulp at 81% ISO brightness in the earlier system i.e. without oxygen delignification.
7. The yellowness of pulp reduced by as much as 4 to 5 percentage points.
8. The viscosity of pulp at 83% brightness was comparable to that of 81% brightness pulp prior to implementation of ODL i.e. 6.2 cp.
9. With the reduction in the yellowness of pulp, the shade of paper improved considerably.
10. There had been an increase of 0.10 Tns of black liquor solids per ton of pulp i.e. approximately 5% increase in black liquor solids.

Introduction of Oxygen in the alkali extraction stage of bleaching:

Oxygen generated from the Oxygen plant is utilized in the Alkali Extraction stage of bleaching thus making it Eop from the earlier Ep stage. About 6kg of oxygen is used per ton of bleached pulp. It is observed that the effect of oxygen in extraction stage was that the hypo consumption in terms of chlorine could be brought down by about 6 kg/tn of bleached pulp for the same level of brightness.

The properties of pulp before, after implementation of oxygen delignification plant and with the introduction of Eop along with ODL are given in Table No.-1.

After the implementation of all the above projects AOX content in the treated effluent came down from the earlier 1.6-1.8 kg/Tn of paper to 0.8

Table-1

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Unit: Central Pulp Mills

PULP EVALUATION REPORT

Furnish: Bamboo 60% + Hardwood 40%

Particulars		CEpHH pulp	With ODL and CEpHH	With ODL and CEopHH
Initial Freeness	°SR	17.5	18.5	18.5
Final Freeness	°SR	45	45	45
Beating Time	Min	34	30	35
Breaking Length	Meters	4660	4950	5150
Burst Factor	Mullen	37.0	36.6	38.3
Tear Factor	Elm	66.6	63.3	68.3
Double Folds	MIT	28.0	26.0	26
Bulk	cc/g	1.43	1.40	1.45
Brightness ISO	%	81.5	83.1	83.0
Viscosity (0.5 % CED)	Cps	6.0	6.0	6.1
RH/Temp.	(%/ °C)	63 / 33	65 / 28	65 / 28
Specks count	PPM	6	3	2
Fiber Classification (Clark)				
+20 mesh	%	28.6	24.2	26.2
-20+50 mesh	%	27.2	29.8	30.8
-50+65 mesh	%	10.3	11.3	11.4
-65+125 mesh	%	4.2	5.2	5.3
-125 mesh	%	29.7	29.5	26.3
Strength Index		**1528**	**1485**	**1545**

to 1.0 kg/Tn of paper after the commissioning of ODL Plant and oxygen bleaching in the alkali extraction stage.

B. Utilisation of treated effluent and colour removal from effluent:

In Central pulp mills a unit of JK Paper Ltd treated effluent is utilized for several purposes. Schemes were made and implemented for utilizing the treated effluent for plantations in and around the mill. About 800 M^3 of treated effluent is utilized for this purpose. Apart from plantations treated effluent is also used for washing the raw material at chipper house and fly ash handling plant. Nearly 1000 M^3 of wastewater is utilized as of now. Efforts were made to procure Govt. land in and around the mill for irrigation purposes but Govt. of Gujarat informed that no land is available to spare to the mill for this purpose.

For the removal of colour from the treated effluents of paper mills so far no technology is available, which is technically feasible and economically viable. Till such technology is developed compliance for colour removal from the paper mill trade effluents should not be enforced.

C. Conservation of water:

Several water conservation schemes were prepared and implemented over the last several years. Due to the efforts made water consumption in the mill has come down from 147 M^3 per ton of paper in 2001 to 142 m^3 per ton of paper in 2005. Details of the schemes implemented and the quantity of water saved are furnished in Table-2.

D. Installation of lime- kiln:

In the CPM unit of JK Paper, the major raw material used is bamboo, which has high silica content when compared to hardwoods. Silica in black liquor is detrimental for the smooth and trouble free operation of limekiln. A pilot study was conducted by CPPRI in the mill for the de-silication of weak black liquor by carbonation method, a technology developed by CPPRI. The results of the pilot study were favourable in the sense that about 80% silica removal could be achieved by carbonation technique of weak black liquor, while maintaining a ratio of 70% bamboo in the raw material mix. However the commercial success of this technology in mill scale upgraded version is not established so far and the options available are very much limited. In the absence of process guarantees for achieving the results it is difficult for the mill to venture into huge investments required for the installation of limekiln as desilication of black liquor has a direct bearing on the performance of limekiln. Until a technically feasible and commercially proven process is available for this vexing problem of silica, mills which depend upon bamboo as their main raw material, should be allowed longer time frame for the installation of limekiln.

E. Odour removal:

As regards odour control by burning the reduced sulphur emissions in boiler/limekiln there had been no norm stipulated for these gaseous emissions so far as was done for AOX. In the absence of such base line it will not be proper to venture into huge investments, as the end result could be something different and inadequate. The minimum tolerance limit needs to be first laid down based on which each mill can adopt the optimum solution based on scale of operation raw materials used, processes adopted etc instead of going for some system on an adhoc basis. CPM has asked for extension of time limit to comply with this CREP requirement.

CONCLUSION

The implementation of Oxygen Delignification Plant helped in achieving the objectives of implementing this project in terms of reduction in the consumption of chlorine, reduction in colour and AOX in the effluent.

GENERAL COMMENTS

All the projects that need to be undertaken by different mills to comply with the CREP requirements and in some cases like lime sludge reburning there had been no proven technology available for the desilication of black liquor without which, lime sludge reburning project does not yield the desired results. This puts the bamboo based paper mills in a disadvantageous position compared to mills based on

Table-2

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WATER CONSERVATION SCHEMES

Scheme	Water saving m^3/d
• Recycling of continuous blow down water of AFB Boiler No. III to hot water tank at causticising plant for reuse in washing of calcium carbonate sludge at mud washer.	24
• Recycling of cooling water from brake drum of rewinder to clear well (treated water reservoir).	240
• Recycling of sealing water of mechanical seal of black liquor injection pump to raw water clarifier for treatment along with raw water from canal.	43
• Provided thirty push type stop cock in urinals/toilets	108
• DM Plant Filter back water collected in Recovery sump and back to raw water clariflocculator.	100
• Level control system provided in colony over head tank	200
• Evaporator seal pit water used in BSW-III washer in pulp mill and lime scrubber in Causticising.	260
• Treated effluent used in Effluent Treatment Plant and Chips washing.	600
• Hypo washer back water is used in Decker dilution in Pulp mill.	2000
• ODL plant compressor cooling water collected in sump and back to clear well	720
• Fresh water for vacuum Pumps sealing water in paper machine replace with clarified paper machine effluent	2160

hardwoods. In certain cases like odour control by burning the reduced sulphur emissions there had been no norm stipulated as was done for AOX. In the absence of such base line it will not be proper to venture into huge investments, as the end result could be something different and inadequate. The complexicity of the industry considering the size of the mills and huge investments without financial help in terms of soft loans, subsidies etc need to be reviewed. To make CREP implementation more meaningful and for the betterment of environment the industry needs support not only in terms of finance but also in the time frame for CREP compliance for identification of appropriate and proven technology.

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