Zero Discharge To River From An Integrated Pulp And Paper Mill - An OPM Amlai, Initiative

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ABSTRACT

Orient Paper Mills, Amlai is an old integrated pulp and paper mill. There is a continuous effort to reduce water consumption per Ton of paper produced. The plant is a pioneer in effectively using the treated effluent for its own plantation through HRTS and do not discharge any coloured effluent in the river. The volume of non-coloured discharge to river has significantly reduced. The recent efforts of conservation and reuse of paper machine back water has added to the continual efforts of water conservation and reuse. This has resulted in reducing the discharge of treated effluent to river. More efforts are dwelled upon to adopt and upgrade the existing technology by adoption of Hot Screening of unbleached pulp and Oxygen delignification processes using Vacuum washer & Twin Roll Presses for washing. This has improved the black liquor solids & reduced the environmental impacts on reduction of effluent volume and AOX in the discharge. It is also planned to recycle the clarified & treated Grade-II effluent at the various locations. The pertinent efforts and endeavors can make the first Indian integrated pulp & paper mill zero discharge mill in India.

Introduction

In the last decade the pulp and paper industry in India has witnessed many modifications in its process in order to increase productivity, product quality and environmental performance. Water is becoming a scarce resource and there has been significant debate among the legislators with regard to taxing water use for industrial purpose. Thus, minimisation of water use has been a burning issue amongst the Indian Pulp and paper Industries.

The economist opines that industrial water use is closely linked to the economy of a country. So far as India is concerned, as GDP increases, so will industrial water consumption. According to MoWR, industrial water use in India stands at about 40 billion cubic meters or nearly 6 per cent of total freshwater abstraction. According to CPCB the annual water consumption in Indian industry is 40 billion cubic meters and the annual wastewater discharge is about 30.7 billion cubic meters. Therefore, the overall ratio of freshwater consumption to wastewater discharged in Indian industry works out to be about 1.0 : 0.77. That is, for every cubic meter of water consumed by Indian industry, 0.77 cubic meters of wastewater is discharged.

Water scarcity is already taking its toll on industrial production. In summers, when most Indian rivers run dry, it is not uncommon to see companies closing shop. The study undertaken by the Confederation of Indian Industry and the World Bank in 2003, finds out that water availability is one of the major infrastructural and future industrial growth bottlenecks. Indian industry can no longer ignore water management issues if they are to grow and become globally competitive.

Water use in Indian pulp and paper industry is very high due to combination of factors including obsolete process technology, poor recycling and reuse practices and poor wastewater treatment. Water once used is generally thrown without any further use, even if the water is not much contaminated. Segregation of wastewater from various processes into clean wastewater, (that can be reused) and contaminated water is not commonly done. The result is that even the uncontaminated water gets contaminated after mixing and is discharged as effluent.

The key to the problem lies in effective management of water resources. An integrated approach involving water treatment, source reduction, reuse of process water, effluent treatment, recycling of treated effluent and waste-minimisation is urgently required which is elaborated bellow:

a) Improve process technology: Clean and advanced process technologies can help industry reduce its water demand. For instance, by replacing the conventional bleaching process with totally chlorine free bleaching process, pulp and paper companies can almost close their water cycle. But it calls for higher investment.

b) Reuse process water: This involves reusing water in a series, in an open system, for two or more successive but different purposes. This enables use of poor quality water for more than one purpose.

OPM, Amlai Initiative:

Orient Paper Mills, Amlai is an integrated pulp & paper mill. There is continual involvement & initiatives taken to reuse and recycle the process or treated water for fresh water conservation. Segregation of effluent is practiced since beginning as suggested and advised by M/s NEERI an independent environmental consultant for effective treatment and recycling the effluent. The mill effluent is segregated into 3 grades as below:

Grade I:

This includes cooling & condensate from paper machines, evaporator and turbine, which are collected and reused in the system. Cooling water from the spray pond is collected and pumped back into the circuit.

Grade II: (25,000 m^3/day)-

This effluent constitutes mainly white water from the stock preparation, paper

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machines and the outflow from chlorination and chlorine di oxide stage of the bleach plant. Wash water from the chipper house and grit collector, lime sludge filter and vacuum pump drain water also mixes in this stream. This stream has low pollution load and was easily treated. Clarified water after primary clarification, around **8000 m^3/day,** is recycled back to the chippers for log washing and to boiler house for ash quenching. Rest of the clarified water is further treated in an oxidising pond with surface aerators to ascertain the MPPCB norms and discharged to river to the tune of about **17,000 m^3/day**.

Grade III: (10,000 m^3/day)-

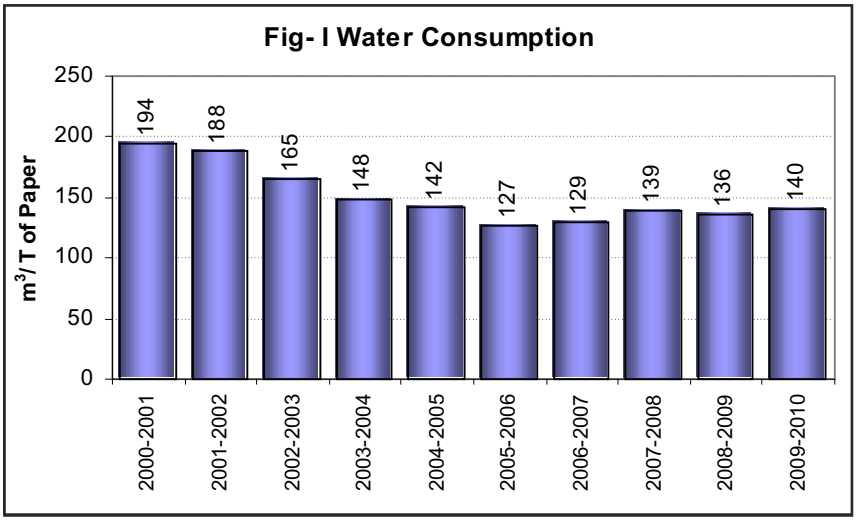
This section includes effluents from digester area, screening section, brown stock washing, alkali extraction stage of the bleaching section and all other coloured spills in the pulp mill area and soda recovery section. This effluent has high in pollution load in terms of SS, COD, BOD and Colour. The treatment includes a coarse screening followed by primary clarification. The clarified effluent is treated in an anaerobic lagoon and then sent for Activated Sludge Process treatment. After secondary clarification the clarified effluent held in the oxidation ponds before using the total effluent for High Rate Transmission System (**HRTS**) in the captive plantation.

The flow diagram of the existing waste water treatment system is given in **Fig: V.**

Water Conservation Initiatives:

A continuous effort has been instituted to conserve water use. The results are depicted in **Fig: 1**. Since the beginning of the decade the water consumption was in the range of 194m^3 /T, in the year 2000-2001, which was brought down to an average of 136m^3/T till the year 2008- 2009.

Fig- I Water Consumption

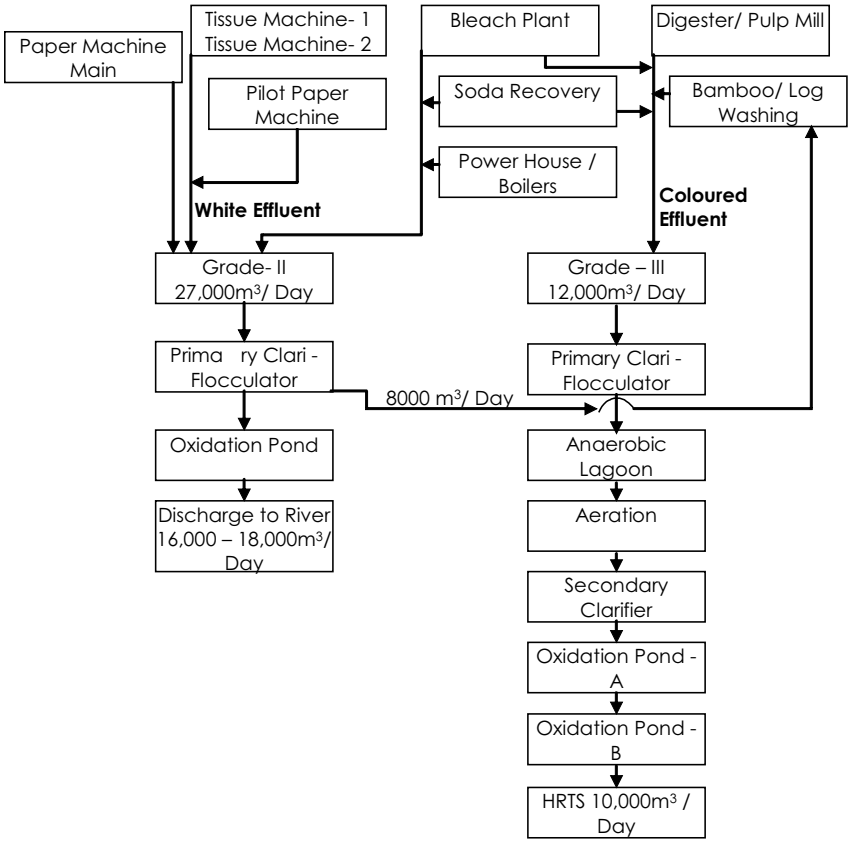


Present Water Conservation Strategy:

a) Machine Back Water:

Present paper discusses the water conservation strategies taken and future prospects. The White water from the machines and the Vacuum pump water were being drained. Fresh mill water was being consumed at these locations. Now PM/c white water & Vacuum Pump water is sent to a clarifier with a polymer application for better settle-ability and bromination of the clarified water was carried for needed microbial sanitation. The clarified water was used in all sections of the pulp mill, PM/c vacuum pump,. This has resulted in reducing the total water consumption.

Fig: V: EFFLUENT FLOW



b) Screening & Washing Up-gradation:

We had conventional 4 stages brown stock washing system followed by 2 stage screening, 4 stages centri-cleaning and thickner. This system has been replaced with the state of art technology consisting of 3 stages hot screening followed by 3 stages washing with twin roll presses, oxygen delignification stage and two stages of post ODL presses. This up-gradation has resulted in water saving (to the tune of 126 m^3/T in the month of Nov 2010), due to reduced dilution factor and recovery of liquor from post ODL process.

c) Other Process Initiatives:

o Clarified machine back water is presently used as seal water makeup instead of mill water.
o Clarified machine back water is used at D stage instead of mill water.
o D-stage back water is used in the Hypo washer instead of mill water.
o EOP stage back water is used in CD washer instead of mill water.
o Pulp mill floor washing is with clarified machine back water.

The above has reduced substantially the water consumption and effluent discharge **(Fig- II).** In the months of July & August the water consumptions are higher due to plant start-up and stabilization of the new process in the pulp mill.

Fig- III: OPM Discharged Waste Water Norms, mg/L

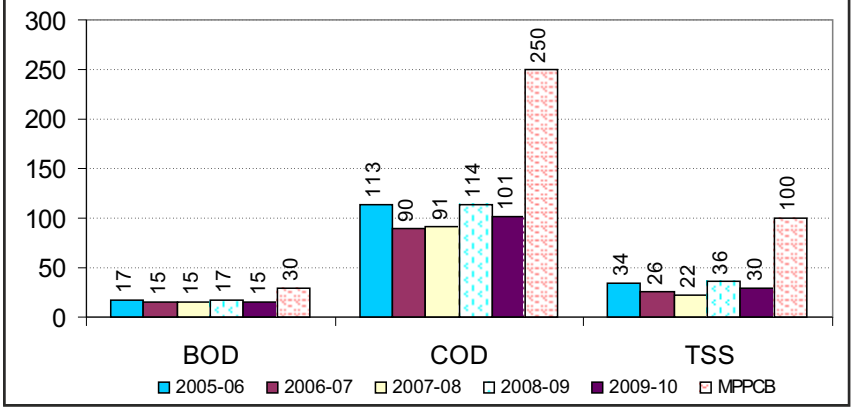
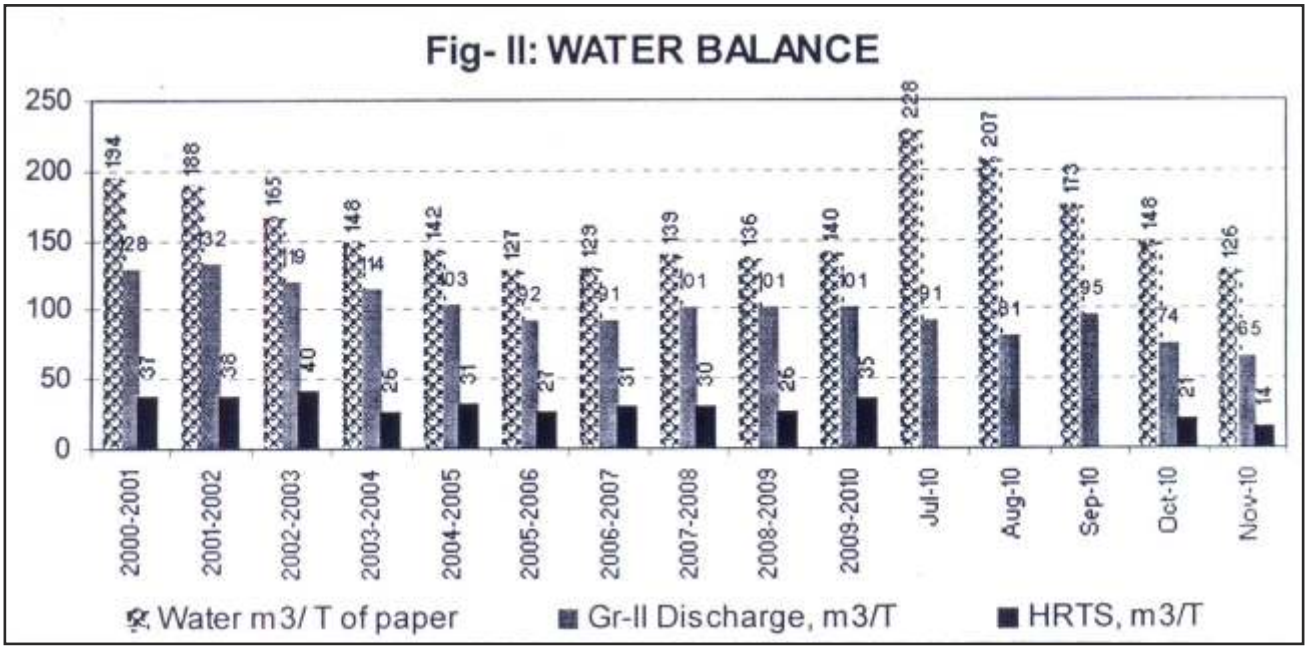


Fig- II: WATER BALANCE



Future action plan:

o C_D-stage back water to be used as diluent after final twin roll press before C_D instead of clarified machine back water presently used. .
o Sludge dewatering at the disk save-all clarifier.

Effluent Treatment & Discharge Initiatives:

The modified effluent flow diagramme is shown in **Fig: VI.**

Oxygen delignification has reduced the unbleached Kappa to around 11 and had an impact on the reduced total chlorine consumption & subsequently reduced the effluent AOX discharge to river **(Fig- IV).**

Grade II treated effluent discharged to river (the only effluent discharged), which was in the range of 100m^3 / T in earlier years have reached a level of below 75m^3 /T in the months of Oct & Nov 2010 **(Fig: II).** The discharge meets and exceeds the MPPCB laid out norms for the industry **(Fig-III).** The reduced AOX discharged to river is shown in **Fig-IV**.

Grade III Treatment up-gradation:

The surface aerators were replaced with forced diffused aeration system, AIRE- O2 TRITON, USA aerator/ mixers supplied by M/s Envirotek, India with out stoppage of the running plant. It is a multiple blower and mixing device which forces the air at an angle to the bottom of the tank with efficient mixing. It is only partially submerged and can be removed at ease for any maintenance work. The benefits of the system are elucidated as:

o Deep mixing capability
o Integral slow speed mixer operates separately maintaining optimum mixing even the air is turned off.
o Increased oxygen transfer as the path of the jet is at angle, it travels a longer distance.
o No aerosol splashing or pathogen release to air in the vicinity.
o Low maintenance with ease of access.
o No stoppage of the running plant for installation.
o No need to increase the height of the aeration tank beyond 4 meters, because of the angular air injection for effective jet length.

This system application at the aeration in pulp & paper mill activated sludge process (ASP) of effluent treatment process is the first in INDIA at ORIENT PAPER & INDUSTRIES, Amlai.

The dissolved oxygen (DO) level of the

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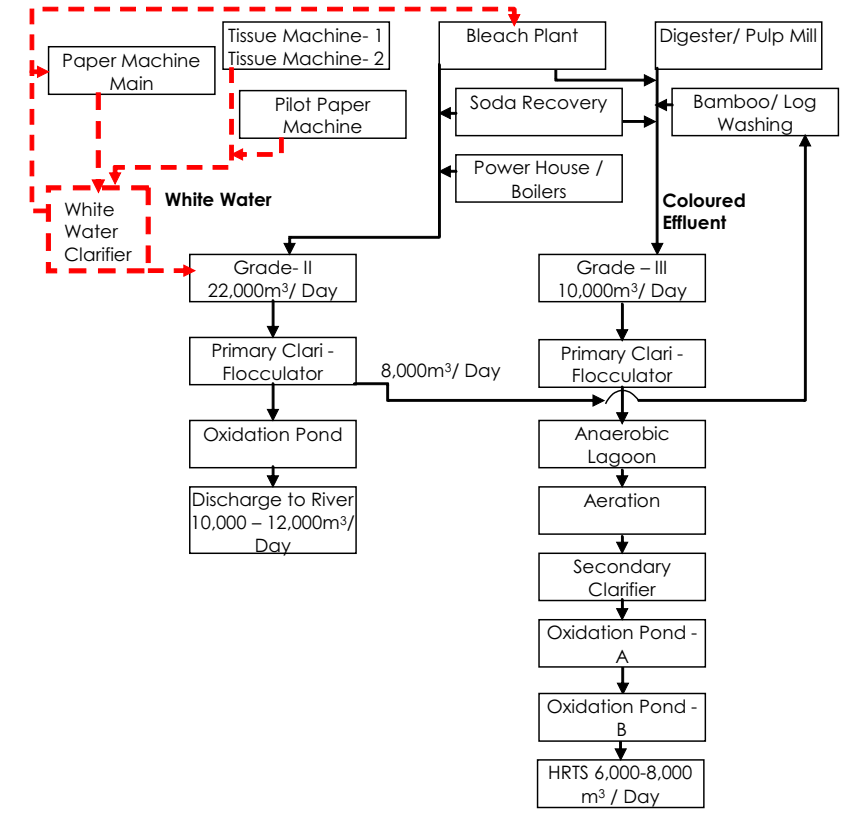
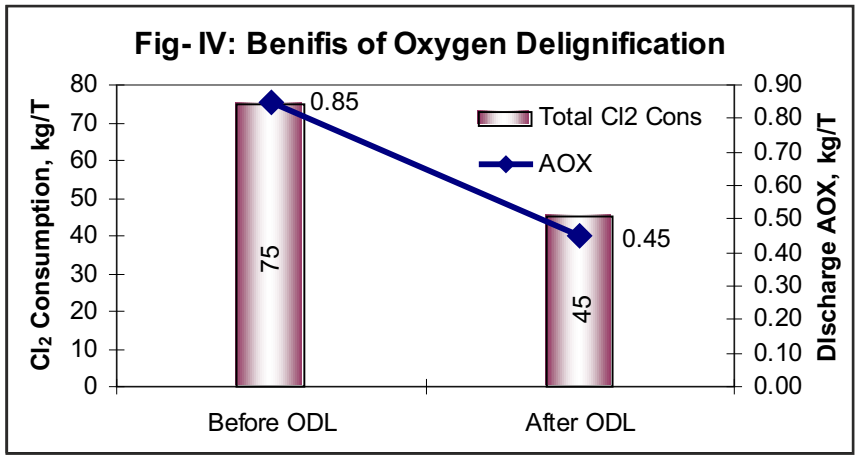
Fig: VI: MODIFIED EFFLUENT FLOW





aeration pond outlet has reached to a level of 1ppm. Optimisation of other parameters of the aeration process is under progress to reach the targeted levels of 1.5ppm.

Conclusion

There is a continual improvement in water conservation efforts and treated effluent discharge. The consistent & persistent efforts to meet the effluent discharge norms of MPPCB are maintained all along. The reuse of machine back water after clarification has further reduced the fresh water consumption and treated effluent discharge as is evident from the Oct. & Nov 2010 figures. The pulp mill up-gradations has shown reduced effluent generation, improvement in black liquor solids increase and reduced AOX discharge to river body.