Water Shortage and Solutions

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Abstract

Our mill having 100 TPD production of Writing, Printing and Newsprint have at present fresh water consumption of less than 40M³/MT after taking various steps for reduction of fresh water consumption at various stages. Our actual fresh water consumption is only 27 M³ /MT on waste paper and the excess quantity of 13 M³/MT is due to the production of 12 MT bleached rice straw pulp. Our 5 MW Power Plant is in operation with close to zero effluent discharge.

INTRODUCTION

Growing environmental compulsions in the industry has forced to look for drastic measures to recycle wastewater and reduce fresh water consumption. This can possibly be done by some improvements of systems and reuse of water from one system to the same and other systems directly or by clarifying it with some viable water treatment and purification technologies. Mill having captive pulp production requires more amount of water than waste paper based mills.

In the global scenario, water scarcity faced by the pulp and paper industries has compelled to find solutions for water shortage and its management. The paper industry has a long history of reducing process water consumption per unit of production. For instance, within the southern kraft industry water usage reduced from 417 M³/T of production to approximately 167M³/T over the period from 1946 to 1956. Industry-wide date for all categories suggest a decrease from 163M³/T in 1955 to approximately 113 M³/T. For non-integrated fine paper manufacturers in 1970 the average process water use was 151 M³/T and by 1972 this was lowered to 100 M³/T. For combination paper board manufacturers, the average discharge went (1) from 36 M³/T in 1970 to 30 M³/T in 1972.

There are examples of non-integrated mills with zero effluent discharge in the manufacture of paper board or tissue. Now the maximum water consumption limit is 250 M³/T of paper as specified by the Pollution Control Board, Orissa. This trend is continuing because of two factors: environmental legislation and rising energy costs. By conservation of process water gives, greater water economy s.a. (a) reduced losses of fibres, fines and fillers (b) reduced cost for purchase or processing of fresh water (c) reduced cost for heating of process streams, and (d) indirectly increasing energy conservation. This can be achieved by control and modification of the systems. Maximum water conservation can be done by recycling the back water without affecting quality. The recycling of back water (having low suspended solids) from each system can be achieved by clarification of washing back water and suitable biological treatments. By water conservation methods, it not only reduces the fresh water consumption but also reduces the effluent generation which indicates less pollution

generated by an industry.

RESULTS AND DISCUSSION

Steps taken to reduce water consumption

A) **Straw Pulp Street:**

Installed a twin drum thickner for washing of unbleached rice straw pulp to avoid

Potcher washing. Previously, black liquor was generated by potcher washing = 360 M^3/d

Now, black liquor generated by twin drum thickner = 170 M^3/d

Therefore, amount of black liquor generation saved = 190 M^3/d

Indirectly, fresh water consumption saved

= 190 M^3/d

The washing back water drained from straw decker thickner was 80 M^3/d. Now, some part of drained water is recycled to BSW washing back water reserve tank so that fresh water consumption is reduced by 30-40 M^3/d.

B) Waste Paper Pulp Street:

Installed high pressure oscillating showers in place of ordinary showers for waste paper street pulp thickner of Newsprint grade mill. As a result, the amount of fresh water consumption for four showers is reduced by 960 M^3/d.

C) Paper Machine:

Our writing grade paper machine, the suction couch roll gear box gland cooling water is totally taken to machine back water tank instead of couch pit. By this, the fresh water consumption is reduced by 40 M^3/d.

In writing grade paper machine, the re-winder gland cooling back water is taken to machine back water tank which is again used as fresh water by save all clarification of machine back water. So the fresh water consumption is reduced by 10 M^3/d.

In newsprint grade mill, two medium pressure showers of machine are stopped so that the fresh water consumption is reduced by 150 M^3/d.

In newsprint grade mill, a washable medium pressure knock down shower overflow is stopped so that the fresh water consumption is reduced by 72 M^3/d.

In newsprint grade mill, the rewinder gland cooling back water is taken to fresh water reservoir by which the fresh water consumption is reduced by 10 M^3/d.

D) Power Plant:

Generally Power Plant consumes more amount of fresh water for steam and power generation. However, the plant is running with minimum fresh water consumption and close to zero effluent system as show in Fig. 1. Power Plant supplies steam to paper machine dryers. The process steam utilized in paper machines gets condensed during heat exchange and the condensed water along with certain heat energy returns to Power Plant water reservoir tank where RO (Reverse Osmosis) Plant purified water is added as makeup water. Along with the TG condensate more than 80% of the total used water is recovered back whereas only less than 20% of total used water is added from RO Plant as makeup water.

For purification, there are so many systems like OC (Oxidation Chamber), PSF(Pressure Sand Filter), DMF (Dual Media Filter), CF (Cartridge Filter), RO Membrane Tubes, De-gasifier, MB (Mixed Bed) etc. For better quality and efficiency, back washing of the system is required. The reject water during this process is being utilized in different locations as mentioned below:

The reject water of RO is taken to cooling tower by which the fresh water consumption is reduced to 50 M^3/d.

The back washing of MB and DMF is taken to a reserve pit and that amount is reused for fly ash conditioning and coal yard dust suppression system.

Previously, the cooling tower blow down is drained. But now, after taking the total amount of blow down to our Pulp Mill (writing grade) save-all overflow reserve tank, the fresh water consumption is reduced by 100 M^3/d.

E) ETP (Effluent Treatment Plant):

Effluent generated from entire plant is treated in

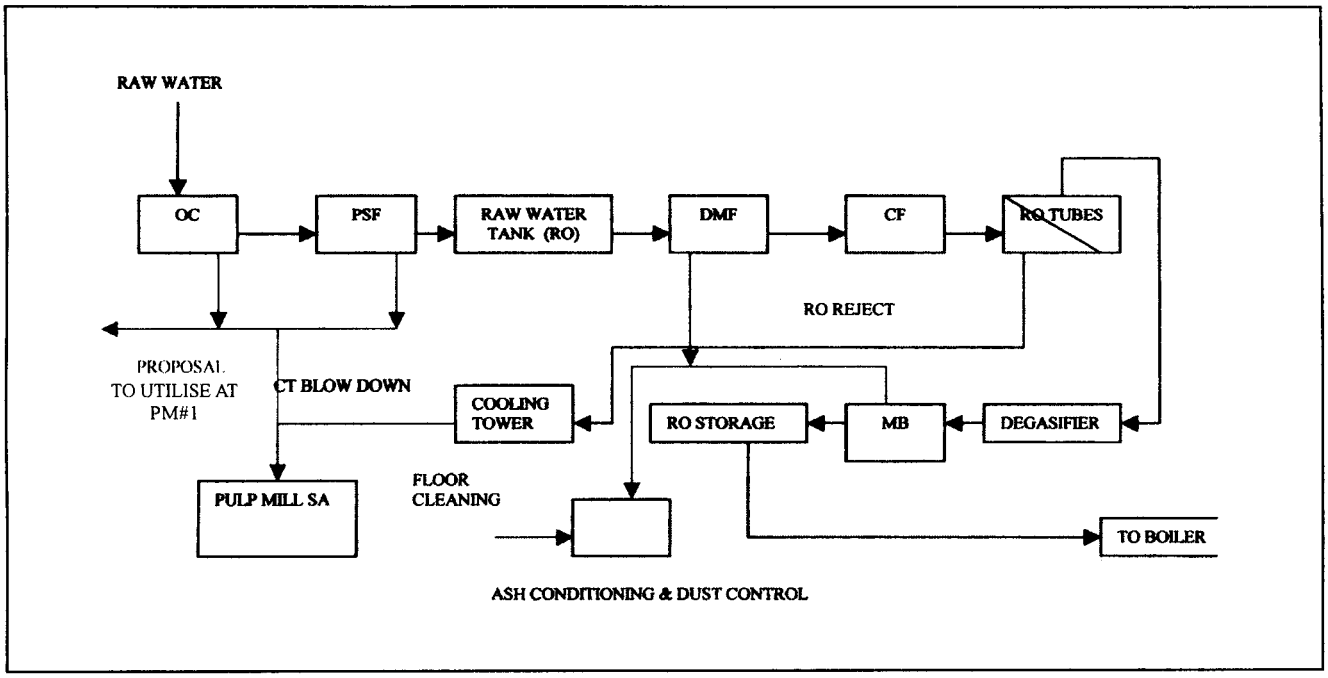

Table-I water quality at different stages

Systems	pH	SiO_2 (PPM)	TDS (PPM)	Fe (PPM)	PA (PPM)	MA (PPM)	TH (PPM)	CaH (PPM)	Cl^- (PPM)	FRC (PPM)	Temp (^0C)
Fresh Water	6.9	40.72	207	0.66	Nil	102	120	96	36	Nil	25-30
Cooling Tower recirculation	8.66	149.9	690	1.26	24	240	398	308	96	0.3	36
Cooling Tower blow down	8.58	147.8	692	1.08	22	236	402	316	98	0.3	29
Oxidation Chamber Pressure Sand Filter	6.84	41.1	206	1.45	Nil	105.3	124	96.3	35.6	0.5	30
Oxidation Chamber & Pressure Sand Filter B/W Mix.	6.93	41.3	208	0.59	Nil	101	120	96.6	33.6	0.36	30.3
	6.9	41.2	207	1.02	Nil	103	122	96.4	34.6	0.43	30.1

N.B.

TDS : Total Dissolved Solids
PA : Phenolphthalein Alkalinity
MA : Methyl Orange Alkalinity
TH : Total Hardness
CaH : Calcium Hardness
FRC : Free Residual Chlorine

full fledged ETP having two primary clarifiers, aeration pond and a secondary clarifier. Chemicals such as coagulant, flocculant and defoamer are used in ETP to meet the desired quality. Except these, we have two belt presses for handling the underflow of Primary Clarifiers. The overflow water parameters like SS and Color is reduced

after doing the chemical treatment at the inlet of primary clarifiers. The final treated effluent meets the prescribed norms laid by the Pollution Control Board, Orissa. Part of treated discharge is used for irrigation purposes.

Previously, in belt presses, the water consumption for showers was 350 M^3/d. But now, after installation of high pressure showers, the water consumption is 250 M^3/d. So the water consumption is reduced by 100 M^3/d.

Plan of action to reduce water consumption

We have taken the following steps for further reduction of water consumption.

(a)For writing grade Pulp Mill, we are trying to recycle more drained washing back water.

(b)For Power Plant, the oxidation chamber and pressure sand filter back washing can be reused for our writing grade waste paper pulp washing, as its quality is suitable for washing purposes, Table-1

So by this process, we will save 20-40 M^3 /d fresh water by reusing for writing grade Pulp Mill washing purposes which is to be added at save-all overflow reserve tank.

Reductions in the requirement of fresh water and the volume of mill effluent, needing treatment of back water by chemical and mechanical methods. So with a green field mill, capital costs can be substantially reduced by using a process design that minimizes water consumption by the aggressive use of inplant recycling. Now, mainly by recycling and some process modifications we achieved a better target for reduction of fresh water consumption. After completion of our proposals (a) and (b), we can achieve a better target for reducing fresh water consumption.

So by all these methods, the water consumption is reduced by 1667 M^3d. The reduction of water consumption for individual systems is shown in Fig-2.

A- Twin drum Thickner

B- Straw Decker Thickner

C- Waste Paper Pulp Thickner

D- Couch Roll Gear Box Cooling

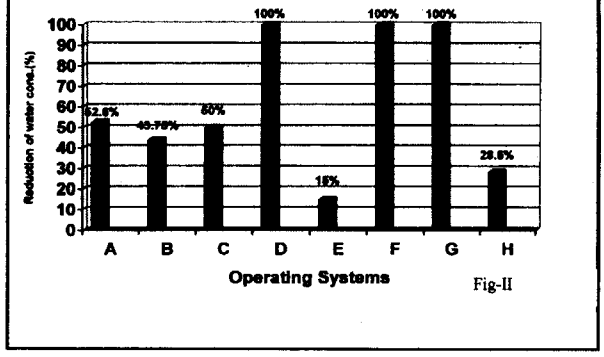

Fig. 2

E- Wire Section (News Print Paper Machine)

F- Rewinder Gland Cooling

G- Cooling Tower Blow down

H- Belt Press (ETP)

CONCLUSION

Increased environmental restrictions are being imposed on pulp and paper effluent discharge limits. But in pulp and paper industry, water consumption is generally high due to washing, cleaning, bleaching of pulp in different stages as compared to other types of industries. Efficient use of mill water and increased white water reuse is less costly than end-of-pipe treatment methods. So reuse of white water in addition to conserve fibres, fines, fillers, heat and energy can significantly reduce the effluent flow, TSS, BOD and COD etc. leads to better environmental management system.

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REFERENCES

1. James P.Casey, Vol-II, Pulp & Paper Chemistry and Chemical Technology - water pollution, P. 1200 and 1201.