

Effluent Treatment and Recycling in Paper Industry

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Abstract

The paper discusses overall water recycling, loop system, effluent treatment and effective effluent disposal on land, encourage plantation and trade crop farming. Applying environmental management system in paper industry will help not only economy but also improve environmental image of the industry.

INTRODUCTION

Water is the lifeline for the paper industry. Stringent control on water consumption in paper industry translates into the economy of the product due to optimized consumption of raw materials, chemicals, and energy. An effective environment management system (EMS) will facilitate overall improvement in efficiency and productivity. Pulp and paper mills energy and water intensive, must pay heed to the environmental impacts associated with their bounteous use of water and energy.

Brown Paper Technologies Ltd (BPLT) formerly known as "The Shirke Paper Mills Ltd." was an integrated pulp and paper mill of 23000 tonnes per annum (TPA) installed capacity located at Shirwal, District Maharashtra. The mill is established in 1982 and has an excellent track record with respect to productivity, quality, energy conservation and Environmental management. The mill manufactures several specialty high quality value added grades of low grammage papers, posters, different grades of

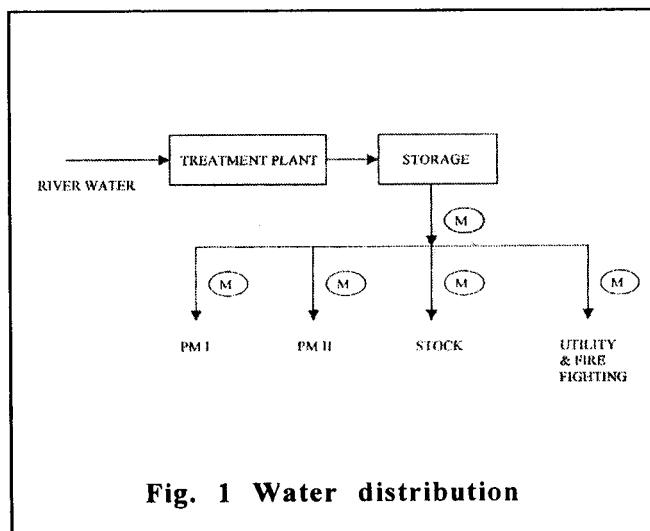
sack papers and newsprint. The mill was having a pulp mill of 30 tpd running with sugarcane bagasse and sodium hypochlorite bleaching and the generated pulp was being subsequently (1998) converted to paper. Four years back, the system was revamped and the system was switched over to recycled fibre line. This change imparted drastic effect on consumption of water and effluent generation.

The company has got an elaborate well designed treatment scheme for effluent based on Activated Sludge Treatment process which incorporates screening, primary clarifiers, recycling, aeration basin, secondary clarifier and sludge handling. Mill has developed the disposal network on own lands having eucalyptus plantation, along with trade farming and green patch development.

RESULTS AND DISCUSSION

Water consumption

With two paper machines, the mill is producing



23000 tonnes of paper per annum satisfying to the customer needs. As the fact says paper industry being highly water intensive, the stress comes on control of water consumption and effluent generation. In an integrated pulp and paper mill, water consumption per tonne of paper goes to 200 to 300 cu.m./t and in recycled fibre based units the figures are 70 to 100 cu. m/t (Table 1).

Table-1 Water used in different areas

Description	Cu.m per hr
Lifted water (RW)	50
Paper Machine (PM 1)	20
Paper Machine (PM II)	20
Stock (ST)	5
Utility & Fire Fighting (UTI)	5

Waste paper recycling saves our environment serves mankind because of conservation of water and energy and effluent treatment is also less expensive than the agro based mills. Brown Paper Technologies Ltd has started working on water to reduce the consumption at the shop floor itself on the principle, "control at source."

Water lifted as per the agreement with the state irrigation department from Veer dam and metered quantities are supplied to the process sides in strict control (Table1).

Table-2 Millwise effluent characteristics

Parameter	Agro based small mills	Waste paper based	BPTL
Effluent, Cu.m./t	187-383 (262)	72-169 (101)	30-60
pH	6.0-8.5	7.1-7.7	68-75
BOD at 20°C, mg/l	220-1067 (550)	100-273 (187)	250
COD, mg/l	2120-4763 (2940)	472-876 (654)	500
TSS, mg/l	600-1115 (815)	350-885 (542)	475
COD/BOD Ratio	2.49-5.4	2.75-5.7	2.00
Pollutional Load			
TSS, Kg/t	155	58	30
BOD 5 Days, at 20°C Kg/t	176	20	11
COD, Kg/t	741	70	22

Any excess use of water on any side of distribution is monitored shiftwise by keeping constant vigil to achieve to the bottom levels.

Effluent treatment plant

The effluent treatment plant is based on ASP (Activated Sludge Process) to treat the total effluent generated from different sections. Switch over from integrated pulp and paper mill to recycled line helps to maintain EMS in the mill showing drastic reduction in quantities and enhancement in quality of effluent.

The two streams viz PM 1 and PM 2 of white waters along with the washes from stock

preparation are isolated and collectively processed through the primary and secondary treatments (Fig.2).

Rich water with chemicals and fibres from each section is first taken to screening with 6 mm perforations and goes to clarification. The separate primary clarifiers are provided with 20 m diameter having 3-4 hours retention are sufficient to clarify the suspensions and fines to the tune of required less than 20 ppm in the recycled water. Almost 70-80% of the clarified white water is recycled back in to the process/stock preparation. The underflow sludge with

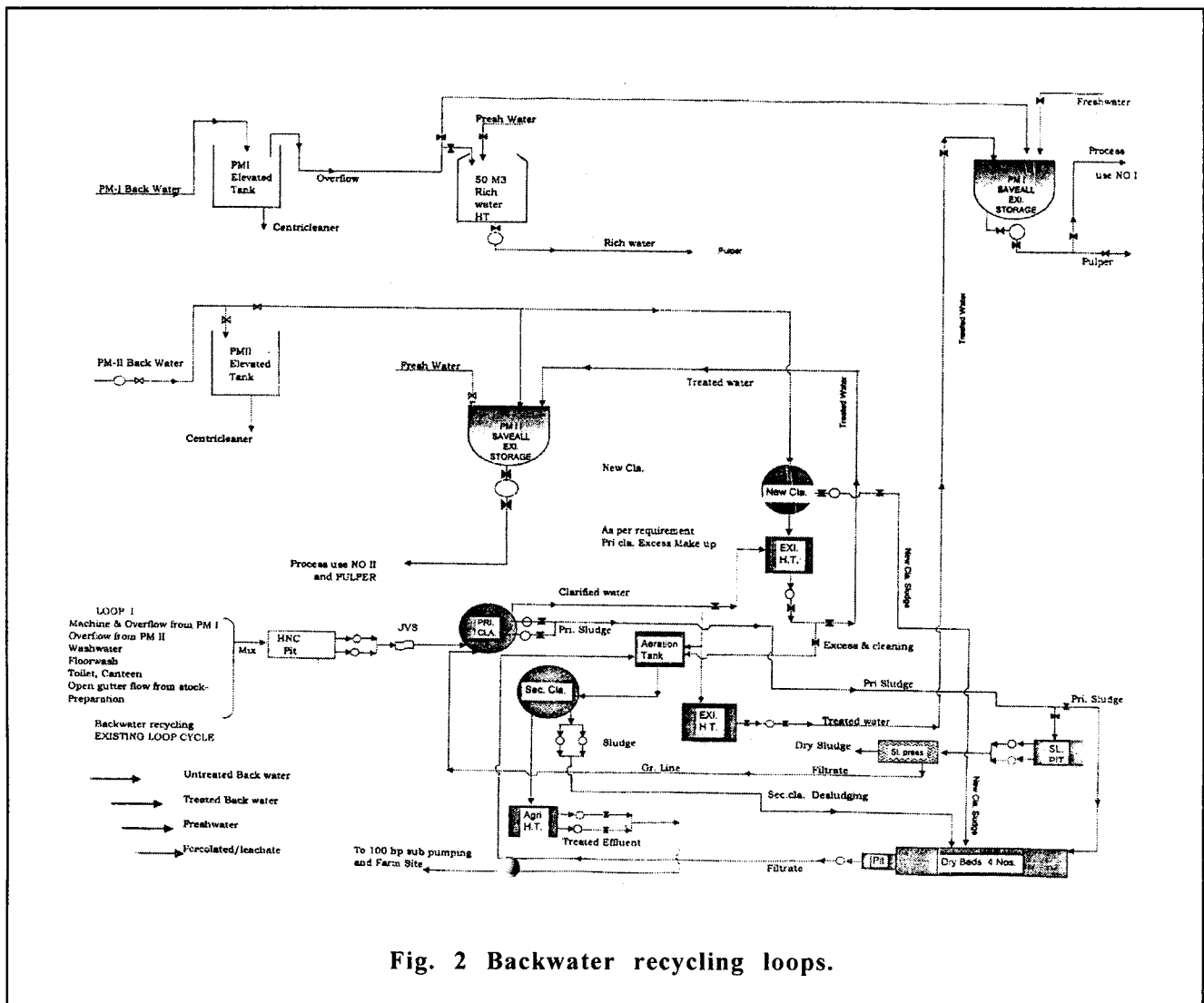


Fig. 2 Backwater recycling loops.

Table-3 Status of effluent generated

Year	Production T/day	Effluent Cu.m/Day	Effluent Cu.m/T
With Bagasse based fibre line			
1995-96	44.23	4693	106
1996-97	54.73	3063	66
With recycled fibre line and closed loops			
1999-00	49.43	3981	57
2000-01	57.39	3149	53
2001-02	64.43	2784	46
Running	65.00	1500	23

0.8 to 2.0 percent consistency is dewatered continuously on a twin belt type filter press with 22 to 30 percent consistency output. The dewatered sludge is sold to nearby sundry board mills on regular basis.

The balanced clarified water in excess goes to a secondary clarifier via aeration tank wherein surface aerators help bringing down the COD and BOD levels are brought down to satisfy the State pollution control board standards for land application (Table 3). The aeration tank is provided with 3 m sludge water depth and 37 kw capacity continuous surface aerator. The waste organic part is converted into a stable biomass, MLSS is maintained with the help of continuous turbulence, adding cow dung as seed when needed and keeping the nutrient levels to

satisfy the BOD requirement. Urea and Di-Ammonium Phosphate are added in the ratio of 100:5:1 of BOD:N:P. The dissolved oxygen level is maintained at 2-3 mg/l with 3500-4000 mg/l of MLSS. The reduction is observed to 85 to 90% (Tables 2 and 3).

This effluent is then processed for settlement in a 20 m diameter secondary clarifier and the treated final effluent is collected in a collection sump, which is ready for land application. As per requirement of the process, the secondary clarified water is also partially utilized along with recycling from primary clarifiers. This results in overall reduction in water consumption (Table 3).

Closed loop recycling fibre line shows the water requirement reduction on each section enabling

Table-4 Raw water cost (yearwise)

Year of agreement	Agreement Quantity, Cu.m/day	Present cost Rs/Cu.m	Monthly Bill Rs.	Remark
Upto 1998	6810	3.48	710964.00	Agro Based Line
1999-2001	3650	3.48	381060.00	Recycled Fibre
2001 onwards	1760	3.48	183744.00	Recycled Fibre

Table-5 Energy consumption on ETP

Year	Effluent Cu.m/day	ETP kWh/t	Cost, Rs. Lacs/year
With bagasse based fibre line			
1995-96	106	58	5.60
1996-97	66	48	4.72 (0.88 Less)
With recycled fibre line and closed loops			
2000-01	53	37	3.62 1.98 Less)
2001-02	46	33	3.20 (2.40 Less)

Table-6 Euealyptus grown with the effluent

Year of plantation	No of species	Mortality %	Height in meters after Rs/kWh			Remark Lacs/year
			6 months	1 year	2 year	
2000	2000	0.5	2.00	8.50	20.00	Clone species BCM: 83, 130, 128, 99
2001	1400	Nil	2.00	10.00	21.00	

lower water demand from riverside and benefits on monthly bills are derived by reducing agreement quantity with state irrigation department (Table 4).

This shows the cost reduction of Rs. 200 to 400 per tonne of production. The recycled backwater on process side to the tune of 70-80% gives low effluent generation and low energy consumption.

Table-7 Plantation/Crop yield status

Crop Pattern	Area in acres	Yield Nos/tonnes
Eucalyptus	150	5,20,000
Tomatto	20	320
Cabbage	15	180
Jawar	60	420
Wheat	40	48

The running hours of all concerned equipments in between i.e. starting from lifting to disposal, get reduced due to low hydraulic load and less organic content. This effect ultimately gives the effect on cost of production (Table 5).

Disposal and plantation

The treated effluent is disposed off on land for self irrigation of Eucalyptus plantation. The disposal system comprises of large network of collecting/receiving tanks, pipes and distribution networks. The pipe network is connected to the subpumping stations and storage lagoons to satisfy area-wise water requirement for irrigation to avoid shortage of water/water logging in low areas. Company has developed a green belt in an area of 150 acres with about 500,000 of eucalyptus species and an additional plantation of 20,000 species every year. Also a plantation of high growth ITC (Table 6) clones were started in the

year 2000 giving encouragement to the organization and outside farmers.

The land is located along National Highway (No.4) creating a green view towards the company to motivate the farmers in command area for trade farming giving yield advantages on cash crop also (Table 7).

Awareness

Awareness among the shop floor people, staff and officers about water consumption, water recycling, use of backwater, etc. is compulsory and should be backed up with continuous efforts. The energy figures and water bills are displayed in the daily meetings with the people to achieve the targeted values. Use of the treated effluent on land for irrigation with trade crops are met with the growing acceptance by the local farmers. Continuous demand of treated effluent for crop farming shows the acceptance and encouragement of the people towards the green development (Table 7).

CONCLUSION

Water recycling/ reuse is to be tackled at all levels starting from shop floor to top management. Efficient effluent treatment with recycling system saves and also money, spent on paper production improves image of the mill developing environment-friendly relations with the society. The overall efficiency and productivity improve employee morale. This kind of reduce-recycle-reuse approach has been adopted as a principle of the environment management system of the company which will definitely help in productivity improvement. The company should accept and adopt any new trend or modifications and technological upgradation in future.

ACKNOWLEDGEMENT

The authors express the great gratitude to the Mr. Situ Shastri, CMD, Mr. Ram Kumar Sunkara, T.D. and Mr. Amlan Pradhan, V.P. to give an opportunity to express these views. Also lot of thanks are extended to all those helped in this regard.

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