

WATER CYCLE ANALYSIS OF SMALL SCALE RECYCLED PAPER MILL

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ABSTRACT

Indian Paper Industry is growing at a rate of 10% on an average across segment and expects to touch 28 million MT per annum by 2025 from the current level of 10 million MT. It is approximately a growth of 200% in 13 years. The main challenges before the Indian Paper Industry are the shortage of fibrous raw material, energy and their high cost. There is an urgent need to bridge the projected supply and demand gap.. For increasing the recycling in India, we should adopt proper policy for collection and recycling of waste paper. The main objective of this research is the water-cycle-analysis of small scale recycled paper mill. A case study of Modi paper mill is reported in this research paper. Modi paper mill, Modinagar Ghaziabad, uses very obsolete technology for washing the pulp. It was proposed that if mill uses new technology for washing the pulp then it will result in reduced water consumption in the process and will also lead to lesser amount of waste water generation. It is recommended that a biogas plant should be installed utilizing the paper sludge to generate biogas.

Index Terms — Pulp washing, sludge, BOD& COD.

INTRODUCTION

In the last few years, Indian paper industry has grown by 6 per cent annually. In the coming years, this growth rate may go up to 10 per cent because of huge demand for writing and printing paper. The industry in the US and Europe is growing at a mere 2 per cent. In other Asian countries, the growth rate is 4.5 per cent. Indian paper industry is worth Rs 225 billion. It accounts for about 1.6 per cent of the world's production of paper and paperboard.

In India, the demand for paper is set to far surpass supply, with the growing emphasis on education, and alternative uses of paper. In 2007, the total domestic demand for paper stood at 72 lakh tons, whereas the production was only 67 lakh tons and by 2015[1], demand may reach the level of 110 lakh tons. It is said that if the gross domestic product (GDP) grows at 10 percent, paper demand grows at 8 per cent. The per capita consumption of paper in India is barely 8 kg. In 2006, there were 525 pulp and paper mills with a total capacity of 64.10 lakh tons of paper and 10.45 lakh tons of newsprint. About 38 per cent of the total demand comes from cultural paper (cream wave), while 58 per cent arises out of the industrial paper sector. The rest 4 per

cent comes from specialty paper, including coated paper, tissues, posters, one-time carbon (OTC), cheques, drafts, etc.

2. PAPER MAKING & RECYCLING

Over the centuries, paper has been made from a wide variety of materials such as cotton, wheat straw, sugar cane waste, flax, bamboo, wood, linen rags, and hemp. Regardless of the source, you need fiber to make paper. Today fiber comes mainly from two sources wood and recycled paper products. Paper mills differ in their processes based on the source of fiber used and the end product produced. There are three basic types of mills: Pulp mills, Recycled paper processing mills and mills that use both recycled and fresh fiber. Pulp mills make pulp, a mixture of cellulose fibers and water used as the basis of all paper products. Pulp is made in several ways, depending on the type of paper being produced. Wood chips, which come from logs or from residues from sawmills, furniture manufacturers and other sources, can be chemically or mechanically separated into individual wood fibers in a process called pulping.

3.A CASE STUDY ON SMALL SCALE RECYCLED MODI PAPER MILL LTD.

A Modi paper mill Ltd is small scale recycled paper mill. This mill is basically manufactured kraft paper from the Indian waste and imported waste kraft paper. This mill was situated in Modinagar Ghaziabad. In this mill there was not any proper arrangement of treatment of waste water. The waste water is simply primary screened, and recirculation back in the process. But, after certain times of recirculation the COD and BOD level of water is very high, (COD = 25,000 to 30,000 mg/l, BOD = 10,000 to 12,000 mg/l) [27] which reduced the paper quality. In this way after certain times of recirculation of water. The water is simply discharge in aerator. This mill was 30 year old, so the technology used in this mill is quite old one. There is no proper maintenance of boiler, washer machine, valve etc; So, the mill consumes a huge amount of fresh water and generate a large quantity of waste water and sludge. So, In this chapter we calculate the amount of waste water generation per day and finding the technology which reduced the water consumption. In this chapter, we also discussed the water cycle in the mill and finding the option were we can used back water in the process which reduced the fresh water consumption in the process.

4.GENERAL INFORMATION OF MODI PAPER MILL

Name of the Unit :- Modi Paper mill Ltd., **Complete address of Unit location:** Modinagar paper mills Ltd. Manufacturers of quality kraft paper. Works and office: Major Asharam Tyagi Road Sikri Kalan Modinagar 201204 (U.P). **Year of Establishment :** 1982

Table 1 Energy consumption in last three years

		2008-09	2010-11	2011-12
Annual Sales turnover of the unit	Rs. Cor.	50	75	100
Plant connected load	kW	1500	2000	3000
Energy cost as % of manufacturing cost	%	14.4	12.8	15.3

Table 2 Capacity and production of Modi Paper Mill Ltd.

Capacity and Production:		2008-09	2010-11	2011-12
Installed capacity	tons / yr	21600	27000	36000
Actual Production	tons / yr	20520	25650	34200
Capacity Utilization	%	95	95	95

In this company basically two type raw materials is used, first one is Indian waste paper (75%) and imported waste paper (25%). The 90% yield has achieved by the company.

Table.3 Raw material consumed tons/ annum:

Year	Indian waste paper (75%) Consumption tons/annum	Imported waste paper (25%) Consumption tons/annum
2008-09	16929	5643
2010-11	21161.25	7053.75
2011-12	28215	9405

Table 4. Consumption of input for unbleached varieties

Input	Unit	2008-09	2010-11	2011-12
Water consumption	m ³ / ton of paper	20	15	11
Steam consumption	Tons/ ton of paper	2.4	2.2	2.0
Electricity consumption	kWh/ ton of paper	470	430	400

Table 5. Water consumption in Modi paper mill and waste water generation existing technology and new technology proposed

S.No	Technology used	Total water consumption m ³ /day	Water consumption in washing m ³ /day	Water consumption reduced m ³ /day	Waste water generation m ³ /day
1	Hydraulic washer	9500	1500	-	1104
2	Chemi or belt washing (proposed one)	8750	750	750	1016
3	Vacuum flume tank to recycle vacuum pump sealing water (proposed one)	7784		1716	903.8
4	Combined technology of 2 & 3 then	7034		2466	816

Fresh water consumption in hydraulic drum washing = 1500 m³/day

Waste water generation = 46 m³/hr

Pumping cost for generation of fresh water for drum washing = ₹40000 per day.

Sludge is 0.4% in waste water generation from mill.

So, from equation (ii) we get;

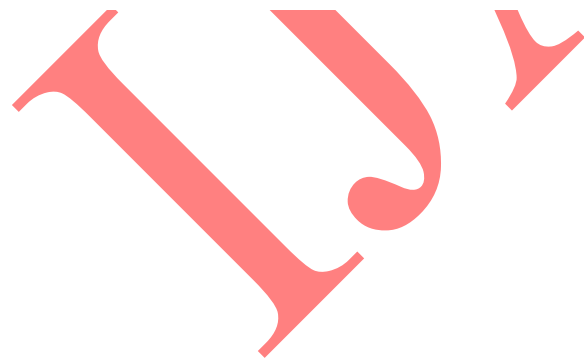
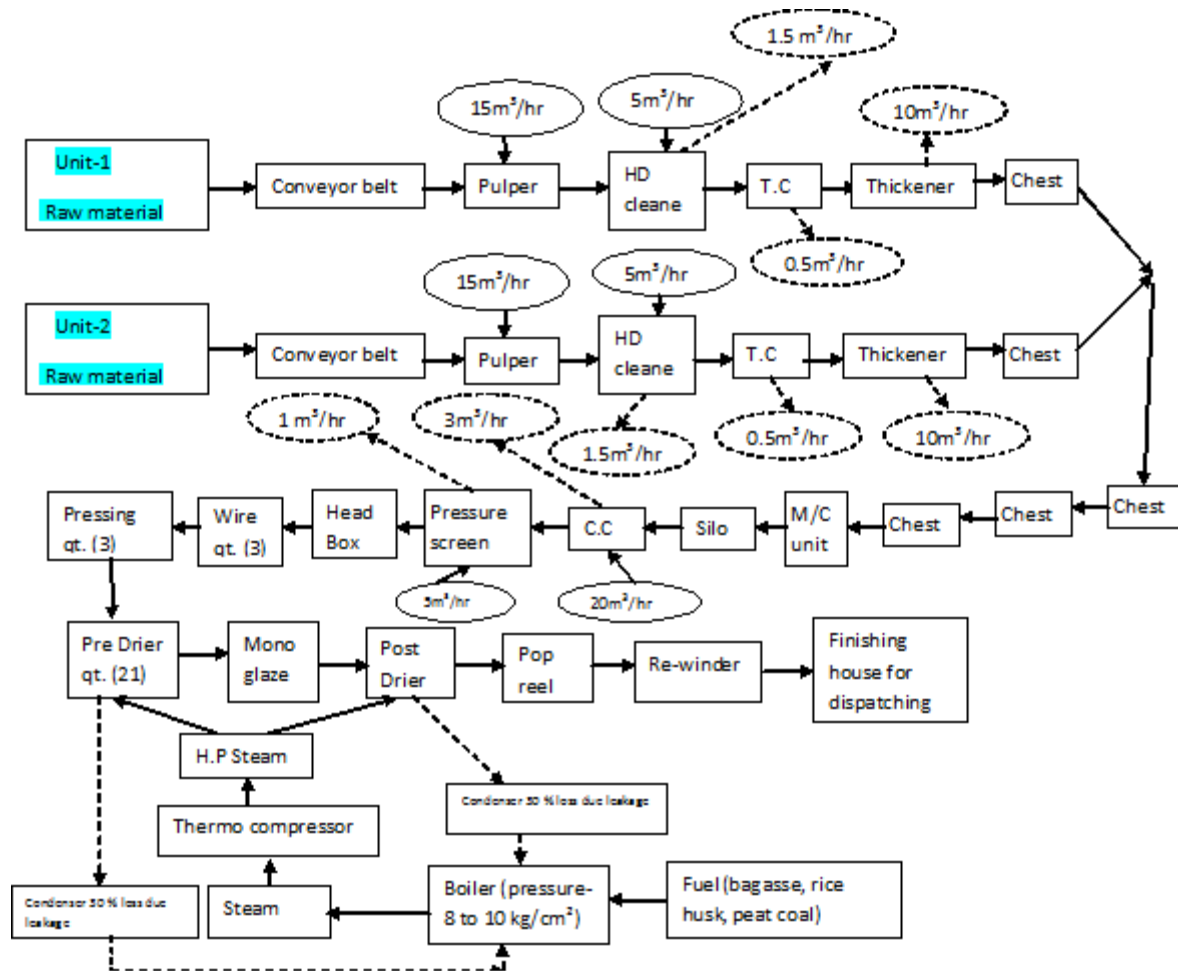
Sludge generation is becomes = $0.004 \times 46 = 0.184 \text{ m}^3/\text{hr} = 4.416 \text{ m}^3/\text{day}$

Total sludge generation/ day = 4.416 m³/day

5. PROBLEM IDENTIFICATION

The main objective of this research paper is analysis of water cycle in a recycling paper industry. The objective of the study was to suggest an appropriate technology after evaluating the various technologies available elsewhere considering the issues are being confronted by the waste paper based mills in India. Discussions held with experts in the field have revealed that this segment of the industry is facing serious problems in processing of imported and indigenous waste papers primarily due to poor quality of indigenous waste paper and presence of contaminants in imported waste paper. Besides, other problems are: large amount of fresh water consumption due to use of obsolete technology, huge amount paper sludge generation, handling problems bad sludge, requirements of large are of land for sludge dumping, and high energy cost of water pumping. In this research paper sincere effort has been made to find the solution of the above problems.

The flow chart of the paper production process depicts two units with the various details: raw materials moves on conveyor to pulper, high density cleaner, turbo cleaner, and to chest serially. From chest the pulp moves to machine unit and passes in sequence through centrifugal cleaner, pressure screen, head box, wire drum, pressing section. Now pulp is ready for drying. It has to go through pre-drying, mono-glaze, post drying, pop-real, re-winder and comes out as finished product.



6. CONCLUSIONS

- 1) The back water from turbo-cleaner, High density cleaner, cleaners and thickner which was going waste is now used in different processing. It has reduced fresh water requirements. It has also reduced the expense on water pumping saving electricity consumption
- 2) Rejects from recycled paper processing contain large quantity of combustible materials such as plastics and cellulosic fibers. Plastics contain only carbon, hydrogen, and oxygen do not present environmental risk, can be burnt in small quantities safely. The plastics waste are polyethylene, polypropylene, and polystyrene. Plastics that contain halogenated compounds such as polyvinylchloride or teflon can not be burnt without creating pollution. The use of paper sludge as a bio-waste fuel for energy production has been recently considered in several pulp and paper mills. Due to its low heating value, sludge must be co-fired with fuels having higher heating value, like bark and wood residues. Sludge co-firing is not popular, because its heating value is very low and the high moisture content of the sludge which affects its capacity to burn efficiently. Low-quality recycled paper represents a valuable source of energy for many reasons: it is easy to separate from the waste stream; it is relatively homogeneous and mostly free from noncombustible materials. It requires minimum processing for incinerating. Its heating value is fairly high. It has low sulfur content, and low nitrogen oxides emissions. Pulp and paper mills are attracted to the proposed technology due to economic reasons.
- 3) The total sludge generation in the plant is 4.41 m³ /day. The company produces a significant amount of sludge per day. If the company installs a biogas plant for anaerobic digestion of sludge then, It can produce a significant amount of biogas which can be utilized as a fuel in boiler. The slurry of biogas plant a byproduct can be used /sold as soil manure.

7. REFERENCES

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