Adoption of Cleaner Technology by ECF Bleaching to Face the Future Environmental Challenges

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ABSTRACT

Environmental problems are invitable in the process of meeting the goals of development. Though the realization for environmental protection has been only two and a half decades old, significant effort to this effect have been made in our country. Still, large pulp and paper mills in our country make a significant contribution in production as well as for environmental protection. This is not sufficient to overcome the present day cry from the people. Paper industry should go for application of cleaner technology in pulp bleaching, such as adoption of Elemental Chlorine Free Bleaching systems. Investment made in such technologies helps the industry to sustain the future environmental issues. Despite many legislations, procedures and regulations being in force for achieving the goal towards environmental improvement, the environmental status has been said to be deteriorating continuously. The people worry about their environment, about the quality of what they eat, drink and use, it is evident that especially the industry will have to conduct itself in a manner, which respects such concerns. Companies that do pay heed run the risk of retribution in the market place. People learn not to buy their products and stock markets don't take kindly to companies that neglect their image and spend reckless night out in the back alleys of shoddy technology and fackless management.

INTRODUCTION

The pulp and paper industry is one of India's important industrial sectors and is more than century old. The per capita consumption of paper in India is only around 3 to 4 kgs. With increasing annual growth rate, the per capita consumption is also expected to reach a level of around 5 kgs. At present, there are about 385 paper mills in existence with a combined installed capacity of about 6.2 million TPA. While 37% of the total production capacity is shared by 28 forest based mills with a capacity of 2.3 million tonnes, a great majority of mills (241 mills) use wastepaper and other nonconventional raw materials to make paper. There are about 111 Agro based paper mills with a total installed capacity of 1.24 million tonnes. However, many of the agro-based paper mills are on the verge of closure due to their inability to confirm to the Pollution control norms imposed by the State Pollution Control Boards. Out of 385 mills, there are only 26 large mills, each able to produce above 33,000 TPA of paper. In view of the above, it has become more responsible for the large paper mills to adopt cleaner production technologies for their sustainability.

Oxygen / Alkali delignification has gained world wide acceptance, since it was applied (1) first time in a South Africa mill in 1970. At present more than half of the world production of bleached pulp in extended delignified by oxygen before final bleaching. The first installations were high consistency oxygen delignification reactors, but since introduction of medium consistency reactor in 1980 more or less all new installations have been of the medium consistency type. Sodium hydroxide or fully oxidised white liquor normally used as alkali source, but even MgO is applied in a few sulphite mills.

Oxygen alkali delignification is a very selective method for removing lignin, and the loss of pulp yield is considerable lower than by any other chemical pulping method. By applying present oxygen delignification technology upto about 50% of the lignin in a pulp may be removed without effecting the strength properties. The dissolved organics and inorganics from oxygen delignification are by counter current washing transferred to the chemical recovery system together with the spent cooking liquor. The

consumption of bleaching chemicals and the amount of organic substances in the effluent from bleaching plants is greatly reduced by oxygen delignification.

BOD and acute toxicity are caused by biodegradable low molecular weight compounds whereas high molecular weight compounds are primary causes of COD, Colour and Chronic toxicity (2, 3). Generally, higher molecular weight compounds are more resistant to biological treatment as it is caused by high molecular weight compounds that are resistant to biodegradation. Aerobic treatment reduces AOX by 25-60% (4, 5). Oxygen delignification can reduce (6, 7) colour by 70-90%, BOD by 81% and COD by 67%. The reduction is due to recycling of organic matter to recovery boiler, where it undergoes combustion (8).

ECF Bleaching

The use of elemental chlorine in bleach plants has more or less come to complete stop in developed countries. This is mainly due to requirements from regulatory authorities and market demands. Extended cooking, oxygen delignification and chlorine dioxide have taken over the role of Chlorine as delignification agent. A standard bleaching sequence for production of high brightness and high quality bleached pulp is oxygen delignification followed by one or two Chlorine Dioxide stages. Small addition of peroxide is frequently used for enhancing the lignin removal in alkali extraction stage. In fact chlorine dioxide is a superior bleaching agent and will therefore during the next decades have a prominent place in production of high brightness and high quality pulp.

Preference of ECF over TCF

The following points prove the preference of ECF pulp over TCF.

- World bleaching pulp production in the year 2000, consists 53% of ECF pulp and 21% of TCF Pulp.
- Paper producers and converters are abandoning TCF, using ECF products.
- At Enocell mill, it requires 6% more wood to make a tonne of TCF Pulp than ECF pulp.
- TCF pulp has lower strength properties than ECF pulp.
- No measurable difference in aquatic environment of effluent from ECF compared to TCF.
- Chlorine dioxide pulp gives stronger and brighter pulp and more efficient.
- Candian Environment and EPA of USA have determined that the best available technology (BAT) for manufacture of bleached karft pulp from softwoods and hardwoods, is the Elemental Chlorine Free (ECF) process.
- World business Council for sustainable development says "There is no appreciable environmental difference between TCF and ECF".

The future challenges to ITC Bhadrachalam on Environmental front

The challenges for ITC Bhadrachalam in the near future will be to produce a required quality bleached pulp at an international competitive cost and at the same time meet the environmental demands from the authorities, market and public. The choice of technology for meeting this challenges is guided by the currently available cleaner technology in pulp bleaching. The objectives are:

- Bleached pulp production to 300 TPA from the present production level of 200 TPA.
- Adoption of environmentally friendly process.
- Emphasis on energy efficiency.
- Adequate Pollution Control measures to mitigate environmental impact.
- Low specific consumption of chemicals, water and energy.

To achieve the above objectives, the following steps are being taken:

- Augmentation of digester plant to increase pulping capacity.
- Installation of new brown stock washing plant.
- Installation of new oxygen delignification plant, white liquor oxidation plant and oxygen generation plant.
- New pulp bleach plant following D1-Eop-D2 sequence.
- Reduction of Pollution load to effluent treatment plant due to;
- Oxygen delignification, with waste water returned to chemical recovery system.
- No use of elemental chlorine in the bleaching operations.
- Improved bleaching sequence resulting in less pollution load.
- New chlorine dioxide generation plant.
- New Chemical Recovery Boiler, eleminating the use

Table 1. Reduction in major chemical requirements

Chemicals	Nautre & Type	Existing (TPA)	After ECF & Expansion (TPA)
Sodium Hydroxide	Liquid	2420	1890
Chlorine	Liquid	3460	--
Hydrogen Peroxide	Liquid	940	320
Burnt Lime	Granular	34160	--
Limestone	Granualr	--	13960
Sodium Sulphate	Granular	3656	3130

Note : Existing : 200 TPD Bleached Pulp, After ECF & Expansion : 300 TPD Bleached Pulp

Table 2. Reduction in waste water pollution loads from pulp mill

Pollutants	Existing (200 TPD)	ECF (300TPD)	Percent reduction
TSS (Kg/T)	46.15	24.06	47.80
BOD (Kg/T)	29.95	13.73	54.20
COD (Kg/T)	92.25	31.17	66.20
AOX (Kg/T)	1.80	0.60	66.70

Table 3. Reduction in total waste water pollution loads

Pollutants	Existing	After ECF & expansion	Percent reduction
TSS (TPD)	27.41	25.40	7.30
BOD (TPD)	10.15	8.28	18.40
COD (TPD)	27.80	19.67	29.20

Table 4. Status of ambient air quality

	Existing ($\mu g.m^3$)	After ECF & expansion ($\mu g.m^3$)	Norm (Residential) ($\mu g.m^3$)
Maximum SPM	148.1	145.9	200
Maximum SO_2	24.0	31.6	80

* Based upon air modeling carried out as per CPCP guideline.

of direct contact evaporators and with high efficient ESPs.

- New energy efficient, falling film evaporators.
- New time sludge reburning kiln with efficient ESPs.

Growth and development in harmony with the environment has always been the approach of ITC Bhadrachalam. This has been amply demonstrated in the previous projects of the company, which had taken the route of 'Cleaner Technology', in the same pursuit, the company is now launching another ambitious project, which will not only mean growth for the company and also for the nation as a whole.

RESULTS AND DISCUSSION

Expected results from ECF bleaching modernisation

After the application of cleaner technology by adoption of elemental free chlorine pulp bleaching and expansion of pulp bleaching from 200 TPA to 300 TPD, it is expected in reduction of specific water consumption to less than 60 m^3 per tonne of bleached pulp, results in reduction of major chemicals, shown in Table 1. Reduction in significant waste water pollutants generated from pulp bleaching section including AOX content is shown in Table 2. In view of reduction in pulp bleaching waste water pollutants, there will be a considerable reduction in total combined wastewater pollutants also, which is shown in Table 3. Improvement is also expected in the ambient air quality due to commissioning of falling film evaporators, which gives higher percentage of solids as high as 70% and firing it in a high efficiency chemical recovery boiler fitted with modern ESPs. The ambient air quality data is shown in Table 4. With advantage of cleaner technology, there is a reduction in solid waste generation also. The generation quantity and method of handling is shown in Table 5.

CONCLUSION

Pulp and Paper Industry has enormous potential for adopting cleaner technology. This industry primarily uses renewable inputs and manufacture products which are recyclable and degradable. The industry can be

Table 5. Status on solid waste generation

Material	Existing (TPD)	After ECF & expansion (TPD)	Method of disposal
Chipper Dust	15	20	Fuel & Vermi Compost
Waste Fibre	28	25	Given for low grade board making
Lime Sludge	200	--	Recalcination & use
Ash	280	230	30% used for Brick making & rest for green mounding

truly sustainable if practices are suitably amended. Adopting cleaner technology is not necessarily a cost intensive proposition. It requires, a will to continuously monitor, examine existing processes to identify cleaner technology options. Cleaner production is a philosophy and a culture, which an organisation has to nurture. It is a means towards continual improvement.

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