# Emerging Technologies For Sustained Development- A Continuous Process At Harihar Polyfibers

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***ABSTRACT***

*HARIHAR POLYFIBERS, a unit of Grasim Industries Limited is situated on the bank of river Tungabhadra. It produces 70,000 tons per annum Rayon grade pulp by Prehydrolysis sulphate process using Eucalyptus. Plant was started in 1972 and is continuously modernised with Process improvements & New equipments with the objective of resource saving & pollution prevention.*

In 1990's the mill has incorporated several emerging technologies in its mill modernization programme for sustained development. The major technologies includes;

(i) Oxygen bleaching, a cleaner bleaching process introduced to reduce effluent load, cost of bleaching and above all better quality pulp.

(ii) Evaporator retrofit with Free Flow Falling Film Concentrator and complete retrofit of Recovery boiler for 70% dry solids with introduction of ambient teritiary air system for improved steam and power generation.

(iii) Process innovation of perfecting technology for commercial scale Biomethanation Plant to treat Prehydrolysate waste liquor, resulted in identification of non conventional source of energy to replace fuel oil in Flash Drying plant.

(iv) Automation of Batch Digesters for better process control and steam levelling.

(v) Installation of pressure knotter in place of open vibrating knotters for better environment and improved working efficiency.

(vi) Installation of third Electrostatic Precipitator chamber in Recovery Boiler for reduced emissions.

Implementation of the above technologies resulted in reduction of auxiliary steam & power consumption with marginal increase in pulp production. The fuel oil in flash drying replaced by Methane gas by 52%. The chemical recovery has improved from 95.5% to 97%. Further it has strengthened the environmental management system with reduced stack emissions and improved effluent treatment plant effectiveness.

This paper describes experience of Harihar Polyfibers in incorporating above emerging technologies.

## i) OXYGEN BLEACHING A CLEANER BLEACHING PROCESS

Owing to random mix of heterogenous species tropical hardwoods, the range of variation of Kappa

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number (K.No.) and viscosity of unbleach pulp is large. Therefore gradual development of brightness is favoured in the bleaching stages. The final viscosity adjustment is achieved by mild hypo stage.

In view of the advantages of oxygen delignification technique with respect to effluent load reduction and bleaching cost saving an investigation was carried out. Various sequences were studied employing oxygen and oxidative extraction stages in combinations: OHED, CE/OHD, E/O CEHD, E/O CE/OD.

Since medium consistency oxygen system are believed to offer more selective delignification reactions, as well as ease of retrofitting in existing mill with small capital investment, it was decided to keep pulp at medium consistency and reaction pressure not in excess of 3.5 Kg/cm$^2$ for trials. A parallel run with conventional CEHED Sequence was also caried out simulating plant conditions for comparison.

Use of CE/O HD sequence resulted in development of reasonable brightness with moderate drop in pulp viscosity while reducing caustic, chlorine and chlorate consumption. While other pulp sequence resulted in poor viscosity control and also requisite brightness did not develop.

CE/O HD sequence was adopted for mill scale operation. The oxygen bleaching was introduced in May 1990 and since then it is in operation continuously.

Our mill experience shows that incorporating oxygen bleaching in alkali stage in conventional CEHED sequence resulted in :

(a) Reduction in Chemicals :

- Caustic : 4 Kg/t
- Chlorine : 5 Kg/t
- Chlorate : 0.5 Kg/t

(b) Reduction in effluent (Pulp Mill)

- COD : 25%
- Colour : 32%

(c) Improvement in Pulp Quality

- Brightness increase by 1%
- Better processability in Fibre plant

**ii) EVAPORATOR AND RECOVERY BOILER RETROFIT FOR HIGH DRY SOLIDS FIRING**

Indian black liquor have been traditionally affected by higher viscosities and the presence of non process elements like silica, potasium and chlorides which restricted black liquor concentration 60-61%. This was responsible for lower smelt reduction efficiencies, higher carry over and secondary combustion, increased pluggage of flue gas passages, lower boiler availability & high TRS and sulphur dioxides emission from stack.

Technological advances in black liquor evaporation and handling have led to global up ward transition in black liquor dry solids from 60-65% in sixties to 75 to 80% during nineties. This has resulted in marked improvements in overall thermal and chemical recovery efficiencies and increased availability of Recovery boilers between cold shuts and reduced emission of sulphurous compounds through the stacks.

Before retrofit, Harihar Polyfibers (HPF) was having two identical five LTV Evaporator streets which were followed by two nos. forced circulation finishers of IPK type and one no. finisher with horizontal heaters followed by vapour separator. Each finisher had a circulation pump driven by 200 HP motor, to maintain required velocity of liquor through finisher. tubes. By operating this system HPF was able to get 60-61% DS. The concentrated liquor was fired in two nos. low odour (direct fired) wall fired Recovery boilers of ABL Make each handling about 215 tpd black liquor solids with 1-2 months runnability between cold shuts. Smelt reduction efficiency was in the range of 89% and the specific steam generation was in the range of 3-3.2 ton/ton BL solids fired.

The Recovery boiler was retrofit in 1996 with New lower furnace, New three level air system of Ahlstrom Technology, New Secondary superheater and screens, New large parallel flow economiser,

new dry ash handling system, additional soot blowers and other acessories. The evaporator was retrofit with Ahlstrom FFFF finisher, additional heaters and conical bottom tank for 70% DS storage.

With the above modification :

* Specific steam generation increased from 3.2 to 3.8 t/t BL solids
* Smelt reduction efficiency improved from 89 to 93%
* BL solids firing capacity increased to 250 tpd
* Runnability of about 4 months.

Harihar Polyfibers have thus got the distinction of being the first Indian mill to successfully adopt high dry solids firing with good operating results.

### iii) BIOMETHANATION PLANT FOR PREHYDROLYSATE WASTE LIQUOR

Conventionally the reduction of high BOD and COD of Prehydrolysis waste stream (generated during intermediate stage of kraft cooking) by anaerobic and aerobic treatment has been a complex problem. Prolong laboratory and pilot plant studies were conducted to generate methane gas from the liquor and also to fix plant design parameters. Finally, a full scale biomethanation plant has been set up in 1995 with Paques B.V. Netherlands having their collaborators Western Paques India Limited, Pune.

The plant is designed to treat 640 $M^3$/day waste pH liquor to reduce COD from 70000 mg/l to 9000 mg/l and generate 18000 $m^3$/day biogas equivalent to 7.5 tons Fuel oil. Now the plant is operating at 70% capacity utilisation. The generated Methane gas is being used for flash drying the pulp replacing fuel oil. The LDO consumption in Flash Drying reduced by 52%.

Being a clean fuel its use in place of LDO in Hot Air Generators resulted in an improved final pulp brightness by 0.5-1.0% which otherwise would have required additional chemical in bleaching.

### iv) BATCH DIGESTER AUTOMATION

The mill has 9 Nos. batch digester for prehydrolysis sulphate cooking. For improved process control, unit incorporated Distributed Control System supplied by Fisher Rosemount in 2 digesters in 1996. Automation of digester resulted in precise control in following operations:

(1) Uniformity in water charging resulting in better bath ratio.

(2) Auto Control of release of non condensable gases to ensure uniform cooking.

(3) Uniformity in prehydrolysis stage venting and draining.

(4) Accurate white liquor charge based on volume and concentration Precise control on reactivity as cooking is controlled based on pH factor & H Factor.

Automation of balance 7 Nos. digesters is expected to complete in mid 1998. This total automation is expected to bring improvement in steam levelling in Digester thus improving Turbine/Boiler efficiencies.

Uncooked knots generated during cooking was separated after blow tank in 3 Nos. vibrating screens. The knots was recycled back to digester through a set of conveyors. This conventional system has the following disadvantages:

- Fumes generation in the operating floor
- Air infiltration affecting performance of washing
- Black liquor spillage
- Carry over of more Fibre along with knots.

In 1997, the Unit installed a pressure knotter system supplied by Ahlstrom which improved the overall screening efficiency as under:

- Fumes generation in the operating floor eliminated

- Air infiltration in Brown stock washing reduced and Alkali loss reduced by 1 to 2 Kg/t $Na_2SO_4$
- Black liquor spillages reduced
- Fibre carry over in knots reduced from 8% to 3%.

### vi) ELECTROSTATIC PRECIPITATOR

The mill while renovating Recovery Boiler in 1996 replaced the spiral electrodes by multipeak electrodes and added a third chamber to improve Ash collection efficiency. Now the particulate emission level has improved by 15-20%.

## CONCLUSION

In the light of above experience, it has been realised by Harihar Polyfibers that for recovery of energy and chemical resource, all emerging technologies must be investigated continuously and adopted on continuous basis. This will not only cut down the cost of production but also strengthen Environment management system. Now the Unit is investigating the possibility of incorporating oxygen delignification, for sustained development.