

# High Dry Solids Firing-Experience At Harihar Poly Fibres

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## ABSTRACT

*HARIHAR POLYFIBERS, A Unit of Grasim Industries Limited, produces annually 70000 ADMT Rayon Grade pulp by Prehydrolysis sulphate process using Eucalyptus and mix wood. The mill is being continuously modernised with process improvement/new equipment & is operating at 97% Chemical Recovery, with total lime sludge recycle. In 1996, with the installation & commissioning of Free Flow Falling Film Evaporator & complete retrofitting of Recovery Boiler for 70% Dry Black liquor solids with introduction of ambient tertiary air system of Ahlstrom design by Enmas Ahlstrom, it is able to meet most of the steam & power requirement by co-generation, thus improving its overall operation economics. Now it has the distinction of being the first Indian mill to graduate to 70% dry solids concentration at the evaporation stage.*

## INTRODUCTION

Technological advances in black liquor evaporation and handling have led to global upwards transition in Black Liquor dry solids from 60-65% in sixties to 75-80% 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.

Indian Black Liquors have been traditionally affected by higher viscosities and the presence of non process elements like silica, potassium and chlorides which restricted black liquor concentrations to 45-50% at evaporator stage and 60-65% at Black Liquor guns after concentrating in Direct Contact evaporators. This was responsible for lower smelt reduction efficiencies, higher carryover and secondary combustion, increased pluggage of flue gas passages, lower boiler availability and high TRS and sulphur dioxide in emissions from stack.

This paper describes the experience of Harihar Polyfibers in evaporation and firing of high dry solids black liquor.

## NEED FOR FIRING AT HIGHER DRY SOLIDS

The positive effects of firing liquor at high concentration are described in detail below.

### Capacity:

As firing concentrations are increased, the resultant gas volume and therefore gas velocities are reduced. As a result of lower gas velocities there is a reduction in carryover rate. Consequently, the boiler, whose sizing is a function of the specific gas velocity and allowable carryover rate, is capable of accepting additional solids input.

### Steam Generation:

As the solids content increases, there is an increase in the high pressure steam production

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capability of the boiler. This additional steam production is a function of the additional energy available for steam generation due to a reduction in water evaporation duty required to convert the black liquor to a self sustaining combustible solid. The overall recovery area steam economy is enhanced, since an increased portion of the evaporation takes place in evaporators at multiple effect economy.

#### **Operating Stability:**

In the operation of a boiler firing high solids, a more uniform combustion takes place, eliminating the peaks and valleys of heat generation that are evident when firing lower solids. The stability of the boiler is also enhanced by increased operating temperature of the lower furnace region. This improves smelt reduction efficiency also.

#### **Emissions:**

The effect of boiler operation at high solid is a dramatic reduction in the SO<sub>2</sub> and SO<sub>3</sub> emissions from the unit.

#### **DESCRIPTION OF EQUIPMENT BEFORE RETROFIT**

Before the retrofit, Harihar Polyfibres was having two identical five effect LTV evaporator streets which were followed by two nos. forced circulation finishers of IPK type and one no. finisher with horizontal heaters followed by a vapor separator. By operating these finishers in combination, HPF was able to get a concentration of 60-61% D.S. at evaporator stage. The two streets together were concentrating black liquor from 17% D.S. to 61% D.S. with a water evaporation capacity of about 80 T/Hr.

Each of the IPK finishers had a circulation pump driven by 200 HP motor, to maintain the required velocity of liquor through the finisher tubes and to reduce the scaling when operating at 60-61% T.S. concentration. Even then, the finishers had to be by passed, once in about 3 months, to clean the tubes by hydroblasting.

The concentrated black liquor was fired in two nos. low odour (direct fired) type wall fired recovery boilers of ABL make, each handling about 215 tons/day BL solids, with a runnability of about 1-2 months between two cold shuts. Smelt reduction

efficiency was in the range of 88-90%. Specific steam generation was in the range of 3-3.2 tons/ton dry solids fired.

#### **MODIFICATIONS CARRIED OUT**

Following Modifications were carried out in the Recovery Boiler No.1 & Evaporator Plants to achieve a BL Solids Firing Capacity of 275 TDS/Day at 70% D.S. and 87 T/Hr.

- New Lower Furnace
- New Three Level Air System
- New Black Liquor Handling & Injection System
- New Secondary Superheater & Screens
- New Large Parallel Flow Economiser
- New Dry Ash Handling System
- Higher Capacity ID Fan
- Modification of ESP
- Additional C & I
- Additional Sootblowers

#### **Evaporators**

- FFFF Finisher
- New C & I
- 2 Nos. Preheaters for each street
- Conical bottom storage tanks for storing 70% D.S.
- Black liquor with higher capacity transfer pumps.

#### **PERFORMANCE AFTER MODIFICATION**

The modifications in Recovery Boiler No.1 were carried out during annual shut of Feb'96. The FFFF finisher was taken into circuit during Aug.'96. The performance was observed at 60-65% D.S. initially and then concentration was increased to 70% D.S. The following benefits have been observed in operating results.

- Increase in specific steam generation from 3.2 to 3.8 T/T BL Solids in Recovery Boiler.
- Higher reduction efficiency in smelt in the range of 92-95%
- Higher BL Solids firing capacity 250 TDS/Day at present production.
- Runnability of about 4 months at higher capacity.
- Stable operation of Boiler.

#### **COST BENEFIT**

In the recent mill modernisation and capacity upgradation programme the unit has invested 315 million INR which is inclusive of 130 million INR for renovation of Evaporator and Recovery Boiler.

With improved steam generation and pulp production the pay back is quite attractive.

#### **SUMMARY AND CONCLUSIONS**

Harihar Polyfibers have retrofitted their Recovery Boiler No.1 and two LTV evaporator streets to increase BL solids firing capacity from 210 to 250 TDS/Day and BL concentration from 60 to 70% D.S. This has yielded very encouraging results in the form of higher steam generation per ton of BL solids, improved reduction efficiency in smelt and better runnability at higher capacity. Harihar Polyfibers have thus got the distinction of being the first Indian mill, to successfully adopt high Dry Solids firing with very good operating results. It is sure that there will be many more mills to follow suit.