

# Installation of Commercial Scale Biomethanation Plant For Treating Prehydrolysate Liquor Waste to Generate Biogas And Replace Fuel in Process Applications

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*ABSTRACT:-- Harihar Polyfibers produces annually 70,000 MT Rayon Grade Pulp from wood by prehydrolysis kraft process. Conventionally the high BOD & COD of prehydrolysis waste stream reduction by anaerobic and aerobic treatment has been a complex problem. Prolong Laboratory and Pilot Plant studies were conducted to generate bio-gas from this liquor to fix plant design parameters. Finally, full scale bio-methanation plant has been set up using PH liquor as a feed.*

*The plant is operating for last 17 months. 60% capacity utilisation has been achieved. Teething problems are being resolved. Thus not only effluent treatment problems are resolved, the gas is being used for Flash Drying the pulp replacing fuel oil, thus giving substantial saving.*

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## INTRODUCTION

Grasim Industries Ltd., is one of the leading producers of dissolving grade pulp and Viscose staple fibre in South East Asia. Harihar Polyfibers (one of the Units of Grasim Industries LTD., produces 70000 metric tons/annum dissolving grade pulp from an admixture of eucalyptus and mixed tropical hard woods. The cooking of wood is done by pre-hydrolysis sulphate process, pulp is washed on counter-current pressure washers and bleached by CE (O) HED SO<sub>2</sub> sequence followed by multistage centricleaning for producing Rayon grade pulp of 90% ISO brightness. The pulp is dewatered in Screw Presses and dried in Flash dryers using light diesel oil as fuel in Hot Air Generators. The Black liquor from brown stock washer is concentrated in 2 streams of long tube vertical evaporators (5 nos.) and forced circulation finisher. The black liquor at 60% Solids is fired in ABL make water tube, wall spray recovery boiler.

The green liquor is recausticized and the lime sludge is reburnt in Rotary Lime Kiln to produce lime of above 86% purity. Mill has 96% chemical recovery. The Recovery Boilers & BHEL Extraction/Back pressure type turbine meets 80% of the mill steam and power requirement. Balance steam and power are met with IJT- Coal fired boiler and grid respectively.

## BACKGROUND

During intermediate stage of cooking, a waste liquor called "Prehydrolysate Liquor (PH-Liquor)" is generated. This liquor is rich in bio-degradable organic matter and analysis is in Table-1.

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**Table-1.**

Parameter	Unit	Value
pH	--	3 - 4
COD	mg/l	70000 - 80000
BOD	mg/l	35000 - 40000
Total solids	mg/l	45000 - 55000
Total suspended solids	mg/l	1200 - 1500
Chlorides	mg/l	200 - 250
Sulphates	mg/l	200 - 450
Acidity as acetic acid	gm/l	7 - 8

Conventional method use large cooling pond and anaerobic lagoons to treat the liquor. The quality of treated liquor after conventional treatment is in Table-2.

**Table-2.**

Parameter	Unit	Value
pH	--	7.8
COD	mg/l	9000
BOD	mg/l	3500
TSS	mg/l	500
Colour	units	15000
Lignin	mg/l	1500
Sodium	mg/l	300

HPF started research work off late in 1985 for tapping the potential biogas from PH-liquor. For this in-house laboratory & Pilot Plant trials were conducted and results found encouraging. Encouraged by this HPF extended its study to analyse various other technological options available in the world.

In this regard HPF's technical team approached Paques B.V.' Netherland, Polymex-Cekop, Poland, Industrial Process Consultants (IPK), Sweden to examine technological options like Upflow Anaerobic Sludge Blanket (UASB), Anitron, Anamet & An-opur-P Processes. During the visit to these countries it was found that biogas was generated from dairy waste and food waste. Also wood sugar and animal feed was produced from PH liquor. But, NO REFERENCE WAS AVAILABLE FOR PRODUCING BIOGAS FROM PH-LIQUOR.

### PILOT PLANT TRIALS

Paques B.V., Netherland having their collaborators Western Paques India Ltd., (WPIL), Pune

showed interest to work jointly at Harihar. Subsequently a pilot plant was designed for UASB process to control multiphase reaction in the presence of bacteria and was installed in April, 91. Extensive research work was carried out for 12 months to optimise the process and generate biogas.

### Trial results:

**Table-3.**

Parameter	Unit	Value
Volumetric loading rate	Kg. COD/M <sup>3</sup> /day	8
COD reduction	%	85
Biogas generation	M <sup>3</sup> /Kg. COD reduction OR M <sup>3</sup> /M <sup>3</sup> pH liquor	0.45 29
Methane in Biogas	%	67
Calorific value	kCal/NM <sup>3</sup>	6000

To utilise heat value available in this biogas, process application such as Hot Air Generators, Lime Kiln & Coal Fired Boilers were identified for replacement of LDO, LSHS & Coal respectively.

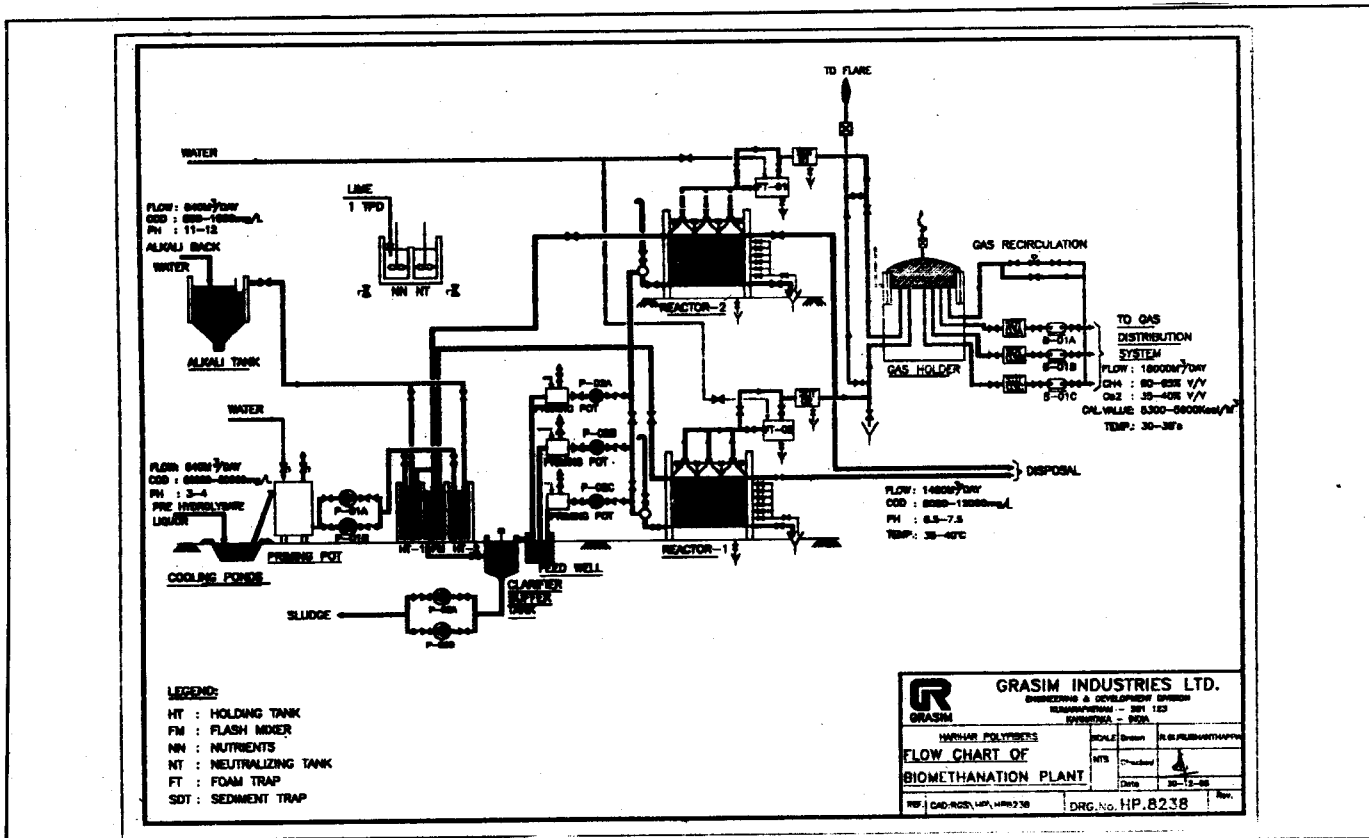
Accordingly, a full scale biomethanation plant was commissioned in may, 95 under Build Own Operate Transfer Scheme by WPIL, Pune. The process flow diagram is shown in Annexure-1.

### PROCESS DESCRIPTION

The PH liquor after cooling in cooling pond is treated with alkali back water and lime to neutralise the acidity. The neutralised liquor is clarified in clarifier. Further, liquor is treated anaerobically in upflow anaerobic sludge blanket reactor which incorporate a unique 3 phase settler to separate the sludge, biogas and the effluent. The gas generated is allowed to leave through collecting hoods and stored in gas holders. The effluent from UASB reactor is further treated in existing biological reactor to meet river discharge standards. From the gas holders gas is distributed to process applications in HAG, Lime Kiln, Coal boilers.

### RESULTS & DISCUSSION

The plant is commissioned in May, 95 and is being stabilised as per predicted capacity utilisation.



For such a critical multiphase bacterial reaction fluctuation in capacity utilisation is anticipated during stabilisation. The plant achieved 60% capacity in Dec, 95. Plant performance till date is as under:

Parameter	Unit	Value
pH liquor waste treated	M <sup>3</sup>	1,36,413
Biogas generated	Million M <sup>3</sup>	3.23
Methane	% v/v	60-65
Carbon dioxide	% v/v	35-40
Calorific value	kCal/NM <sup>3</sup>	5300-5600
LDO replaced	tons	898
Coal replaced	tons	703
Fuel cost saved	Rs. lacs	110

When plant stabilises at full capacity, it will generate 18000 M<sup>3</sup>/day biogas equivalent to 7.5 tons LSHS oil/day worth Rs. 210 lacs p.a. at present rate.

#### ADDITIONAL BENEFITS

- Reduction of smell which otherwise would

have released from open lagoons to atmosphere.

- Effluent treatment is compact due to elimination of large lagoons.
- Biogas being a clean fuel its use in place of LDO in Hot Air Generators resulted in an improved final pulp brightness by 0.5 % which otherwise would have required additional chemical consumption in bleaching.

#### CONCLUSION

It is possible to generate biogas from PH liquor in a UASB reactor on commercial scale. Also this non-conventional source of energy can be used in applications like Hot Air Generators, Coal Biolers to make the UASB tretment system techno-commercially viable. It is also demonstrated that tapping of such non-conventional energy and its use in pulp drying resulted in improved pulp brightness. Hence Harihar Polyfibers have demonstrated that RESOURCE SAVING & POLLUTION PREVENTION go hand in hand.