

# "Energy From Waste" At Century Pulp And Paper - A Case Study

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## **ABSTRACT**

*During Anaerobic Treatment Process, the Raw Effluent is mixed with microorganism in absence of air. The conversion of organic matter into carbon-di-oxide and methane supplies a relatively small amount of energy to the organisms resulting in a slow growth rate of Anaerobic Bacteria. This slow growth Rate results in greatly reduced Sludge Disposal requirement.*

*Anaerobic Treatment of Prehydrolysate liquor (pH Liquor) from Dissolving grade pulp plant in a "Bulk Volume Fermenter Anaerobic Reactor" (BVF Anaerobic Reactor) has been a successful attempt at the mills to generate Energy from Waste. Besides a reduction of BOD & COD levels in the range of 80-90% and 60-70% respectively, generation of Bio gas to the extent of 3855 M<sup>3</sup>/day at full capacity is a considerable gain.*

*The Treatment scheme has been declared as a "Demonstration Plant" by the Ministry of Environment and Forest under the World Bank - IDBI Scheme for Environmental Management, For awarding a subsidy of Rs. 65 Lacs to the company.*

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## **INTRODUCTION**

An Effective Environmental Management Programme, besides fulfilling the basic need of Pollution Abatement can lead to an overall improvement in Quality, Efficiency and Productivity. Century Pulp and Paper has adopted a systematic approach towards a comprehensive Environmental Management right from the inception. "Environmental Auditing" and "Waste Minimisation" form an integral part of the overall Environment Programme. The Cleaner Production Technology incorporated in our Bagasse based paper plant stands testimony to our Commitment to maintain harmony with Environment.

Century Pulp and Paper is an integrated pulp

and paper unit having three different fibre lines with installed capacities of 31,320 TPA Rayon Grade Pulp, 37,250 TPA Writing & Printing Paper based on Eucalyptus and Bamboo and the latest 84,600 TPA Bagasse based paper unit.

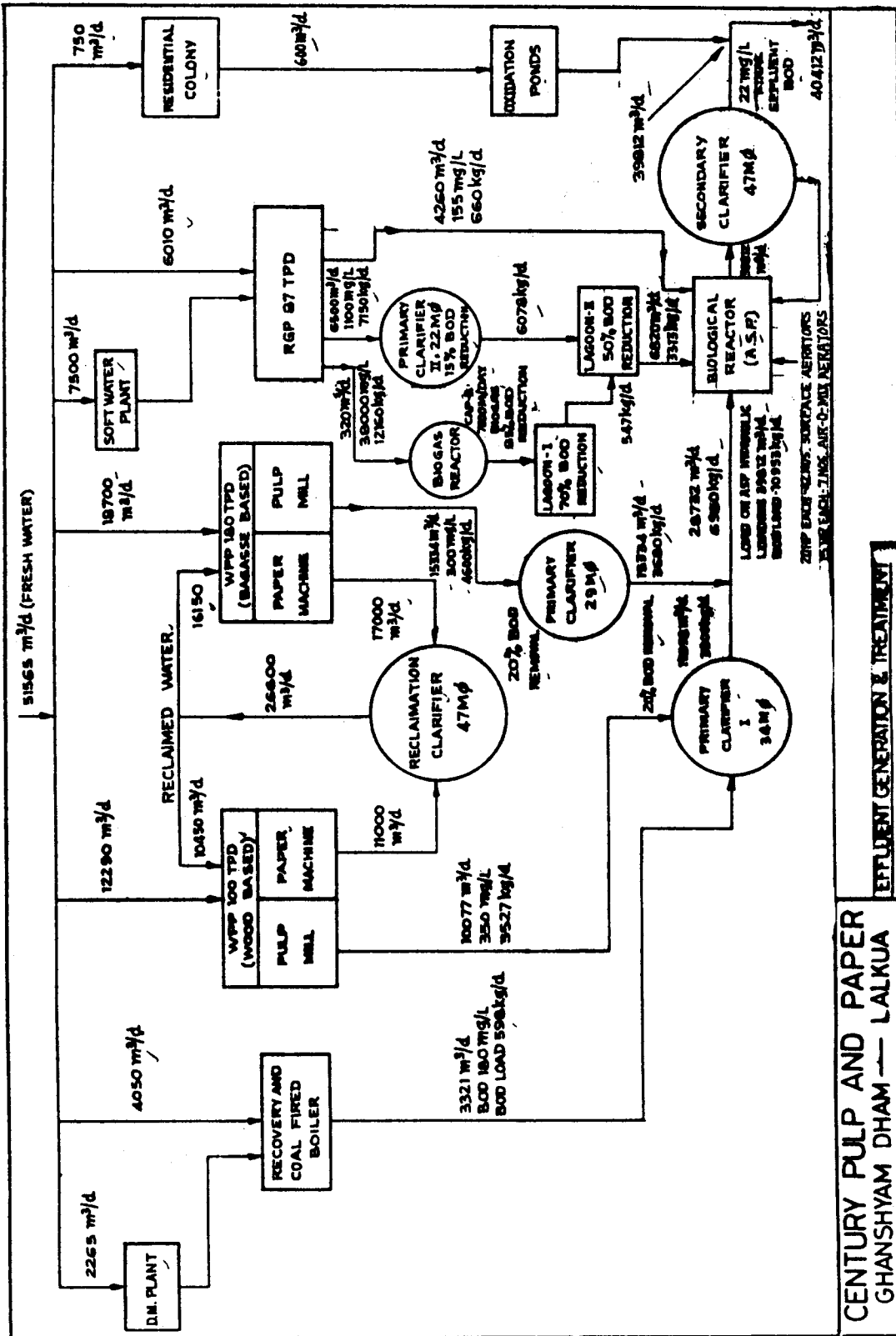
The company has an elaborate, well designed Treatment Scheme for effluent based on Activated sludge process and incorporates primary clarification,

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**ANAEROBIC TREATMENT**

ANNEXURE - I



**CENTURY PULP AND PAPER  
GHANSHYAM DHAM - LALKUA**

**EFFLUENT GENERATION & TREATMENT**

Anaerobic Treatment, Sludge Handling, Aerobic Treatment and secondary clarification.

## BACKGROUND AND FEASIBILITY STUDIES

The streamwise treatment scheme of effluents followed at the mills is as per Fig-1. The Prehydrolysate liquor (pH Liquor) emanating from the Rayon Grade Pulp Plant was earlier treated in two nos. Anaerobic Lagoons with retention times of almost 90 days and 7 days respectively before being subjected to Aeration along with other streams for activated sludge treatment.

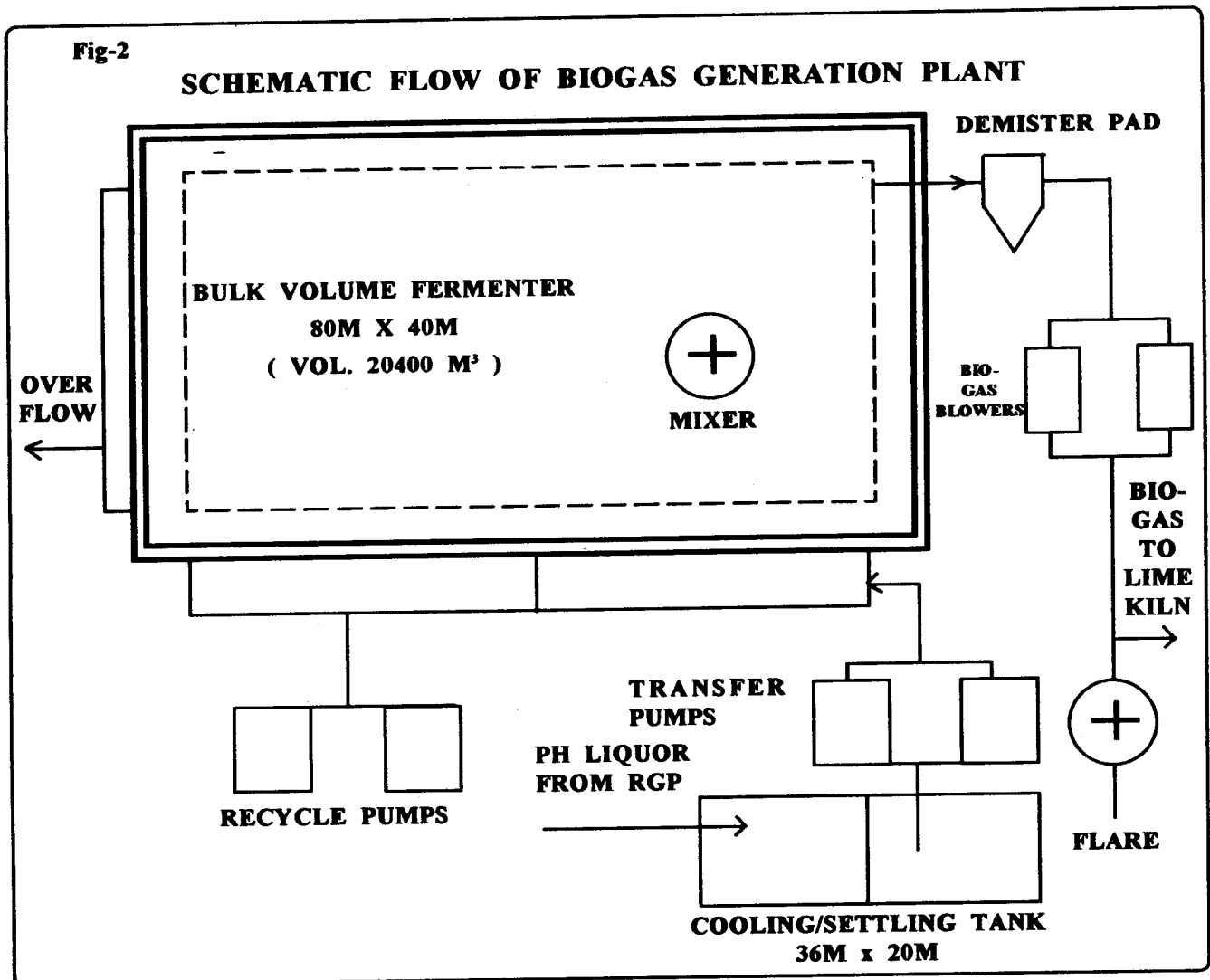
The typical analysis of pH liquor taken for designing the system is as given in Table-1.

In order to ascertain the suitability of Anaerobic

Treatment of this effluent for Bio-Gas generation, Feasibility studies were carried out through M/s Humphreys & Glasgo Consultants Pvt Ltd in collaboration with M/s. Pudumjee Pulp And Paper, Pune. A series of such studies conducted during the year 1991-92 revealed that pH liquor was a good candidate for Anaerobic degradation and for gas generation.

## THE SUMMARY OF CONCLUSIONS INDICATED THAT

- i) The Anaerobic Degradation of Prehydrolysate liquor indicated promising results and showed COD/BOD removal efficiencies of 73% and 87% respectively.
- ii) The Bio gas produced has methane content of 62-65% and 35-37%  $\text{CO}_2$ .



**Table-1**  
**The Prehydrolysate Effluent Quantity And Characteristics**

1.	Total flow	m <sup>3</sup> /day	320-340
2.	pH	--	3.2-3.4
3.	Chemical Oxygen Demand (COD)	mg/l	60000
4.	Biochemical Oxygen Demand (BOD)	mg/l	35000
5.	Sulphates (SO <sub>4</sub> )	mg/l	100-200
6.	Chloride (NaCl)	mg/l	30-50
7.	COD load of the effluent	kgs/day	20400
8.	BOD load of the Effluent	kgs/day	11900

iii) The specific gas generation at 4 kg COD/m<sup>3</sup> has been 0.45-0.48. At this specific gas generation, total 5000 m<sup>3</sup> of Bio gas/day expected considering COD load of 14 tones.

- Ability to handle high strength waste.
- No separate clarifier required.

Based on the encouraging results of the Feasibility studies, Utility Equipment & Management Pvt. Ltd., (UEM) were assigned design and installation of suitable system. UEM conducted further studies at ADI International Inc., Canada to corroborate the feasibility and supplied the plant on a turn-key basis.

**BRIEF DESCRIPTION OF THE TREATMENT PROCESS**

Bulk volume Fermentor (BVF) Anaerobic Digester of 20000 m<sup>3</sup> capacity was supplied, erected and commissioned by UEM (I) with Technical know-how from ADI International Inc of Canada. A schematic Process sheet is as per Fig-2.

UEM Bulk Volume Fermenter (BVF) Reactor was preferred over USAB type due to following :-

- Better process stability to handle shock loads due to high retention time and larger bio mass inventory.
- Ready for quick start up after long dormant time.

ADI-BVF is a RCC Tank having a volume of 60 days hydraulic retention time, with a durable membrane Floating cover and a slow speed mixer. pH Liquor after neutralisation with Soda Ash is fed to the Inlet of Cooling/Setting tank having hydraulic retention time of 2 days. The effluent is fed to the ADI-BVF, through an Inlet Header, spread over the entire width of the Reactor on the Inlet side. Sludge

**Table-2**  
**Analysis of pH Liquor Before & After Treatment**

Parameter		Before Treatment	After Treatment
pH		3.2 - 3.6	6.8 - 7.2
COD	mg/l	40000 - 60000	8000 - 12000
BOD	mg/l	30000 - 40000	4000 - 6000
TSS	mg/l	2000 - 4000	200 - 400
TVSS	mg/l	-----	200 - 300

**Table-3**  
**Analysis Details of BIO-GAS Generated**

- Avg. Calorific Value of Bio gas	- 5000 Kcal/m <sup>3</sup>
- Methane	- 55-60%
- CO <sub>2</sub>	- 35-40%
- H <sub>2</sub> S (Maximum)	- 1.5%
- Nitrogen (Maximum)	- 1.0%
- Moisture (Maximum)	- 5.0%

is recycled into the inlet Header from the bottom of the Reactor, where it is mixed with the incoming effluent and distributed.

The system operates at 25-50 Deg C temperature range. It is covered with a floating membrane cover to collect Bio Gas. Bio Gas generated is removed via a duplex blower system.

A negative Pressure is maintained under the floating cover by connecting it with the suction side of Positive displacement blowers. Bio Gas first passes through demister Pad and finally to Rotary Lime Kiln where a Dual-Burner has been installed.

The Digester's Floating cover is made of high performance reinforced Polymeric Alloy and is inert to corrosive environment of Hydrogen sulphide contained in Bio Gas.

The effluent after treatment is taken to Lagoon no. I and joins the further flow of the Treatment scheme.

The Analysis of Effluent after Treatment through BVF is as per Table No. 2

The Analysis of Bio-Gas generated is as per Table-3.

### **FINANCIAL GAINS AND BENEFITS ACCRUED**

The system has given considerable benefits- both tangible and intangible in terms of Energy Saving and reduction in Pollution Load. Besides, the reduction of about 85% in BOD and 70% in COD loads achieved, generation of 3855 M<sup>3</sup>/day of gas at 90% efficiency gives us a saving of Rs. 21,000/- in term of RFO saved in Rotary Lime Kiln.

**Table-4**  
**Financial Gains: BIO GAS Generation**

COD load of effluent in kgs/day	20400
COD reduction in BVF	70%
COD destroyed in kg/day	14280
Methane generation	0.3 kg/m <sup>3</sup> of COD Destroyed
Optimum Methane Quantity m <sup>3</sup> /day	4284
Considering 90% efficiency achievable	3855 m <sup>3</sup> /day
Avg calorific value of Methane	5300 Kcal/m <sup>3</sup>
Avg calorific value of RFO	10500 Kcal/kg
RFO Saving per day	1946 Kgs
Cost of RFO	Rs. 11/- per Kg.
Saving Per day	Rs. 21406/-
Saving per year considering 330 days working.	Rs. 70.60 Lacs
Capital Cost	Rs. 165.00 Lacs
Payback Period on Capital Cost	2.3 Years
Maintenance & Running Cost (incl.Power, Chemicals & Manpower) Annum	Rs. 20.00/

The details of direct gains are depicted in Table-4

Reduction in Odour (earlier treatment in open Lagoons with high retention period) is another benefit to maintain a cleaner work environment.

### **CONCLUSIONS**

Treatment of high COD-load effluent, pH liquor in a BVF- Anaerobic Digester has given considerable benefits in terms of Energy saved. The system could be experimented and tried by mills having no Chemical Recovery in place. The scheme has been recognised as a "Demonstration Plant" and has been awarded a subsidy of Rs. 65 Lacs under the World Bank-IDBI scheme for Environmental Management.

Century Pulp And Paper has been recommended for the ISO 14001 Certification for Environmental Management System adopted and remains committed to bring about continual improvements in maintaining a clean and healthy environment through innovative schemes as described above.

**ACKNOWLEDGEMENTS**

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**REFERENCES**

- Environmental Management And Waste Minimisation in Century Pulp And Paper - A Case Study by D.P. Chandarana. UNEP Conference, New Delhi 1997-98.
- Feasibility Study Reports : Pudumjee Pulp and paper - 1992.
- Operation and Maintenance Manuals : UEM - 1995.