Innovative Approach to Pollution Abatement at Source – Vapour Phase Prehydrolysis in Dissolving Grade Pulping

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INTRODUCTION

Pulp and Paper Industry worldwide is today looking to gain reputation of being environmental friendly through innovative process technologies, state of art modern plant and machinery and compliance of stringent Government policy on corporate responsibility of environmental protection. Pollution of water through discharge of treated effluents from paper industry is a matter of great concern.

An attempt to control pollution at source through innovative process change in prehydrolysis stage of dissolving Grade pulp manufacturing has come out successfully in total elimination of high COD load from digesters to ETP plant and made the plant environment friendly.

PROCESS DESCRIPTION

Traditionally Prehydrolysis of chips is carried out with hot water in digesters during dissolving grade pulping where in Xylan sugars get hydrolyzed to sugar acids and hemi cellulose content in the chips gets reduced to the desired level of below 3% to produce Viscose staple fiber (VSF) and Viscose Filament yarn. This generates discharge of Pre hydrolysis liquor, which is of high BOD/COD load and treatment of such a high BOD/COD load effluents at ET plant is a costly and unviable proposition.

In the new approach, Prehydrolysis is carried out in presence of saturated steam directly in contact with chips and hence it is called Vapour phase pre hydrolysis. In this process, there is no discharge of high pollutant load prehydrolysate liquor from Digester House to ET plant, thus making the process environment friendly and Energy efficient.

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MATERIAL AND METHODS

Dissolving Grade Pulp manufacturing involves two stage cooking process namely

(1) Prehydrolysis Cooking and (2) Sulphate (Kraft) cooking.

In the process of Pre hydrolysis, Wood chips in cooked in presence of water / steam at elevated temperature in the digester. The process of the pre hydrolysis may be carried out in two ways. In the first process, it is carried out in presence of water, which is called Water phase pre hydrolysis. In the second process live steam of pressure 9.8 kg/cm^2 is injected into the digesters and temp is brought to 164 dec in 75 minutes and cooking done to desirable level of pentosan content in unbleached pulp.

R&D trials were conducted on Vapour phase pre hydrolysis in place of Water phase pre hydrolysis in a single digester.

New steam line with 125 NB control valve was connected to bottom header of digester for direct steam injection. After chips loading, chips are washed with hot water to wer chips, which avoids charring and removes entrained air in digester house. Live steam was injected through auto ramping sequence programmed in DCS and temperature was brought to 164^{0}C. Liquor circulation pump was run to bring uniform temperature across the digesters. Steam valve was closed after steady temperature is attained. Contents are retained for cooking. As soon as pH of the liquor inside digester has come between 3.7–4.0, prehydrolysis is terminated and digester is depressurized for white liquor charging.

After optimization of process parameters and modifications in the digester house, we could run with this new vapor phase prehydolysis in all

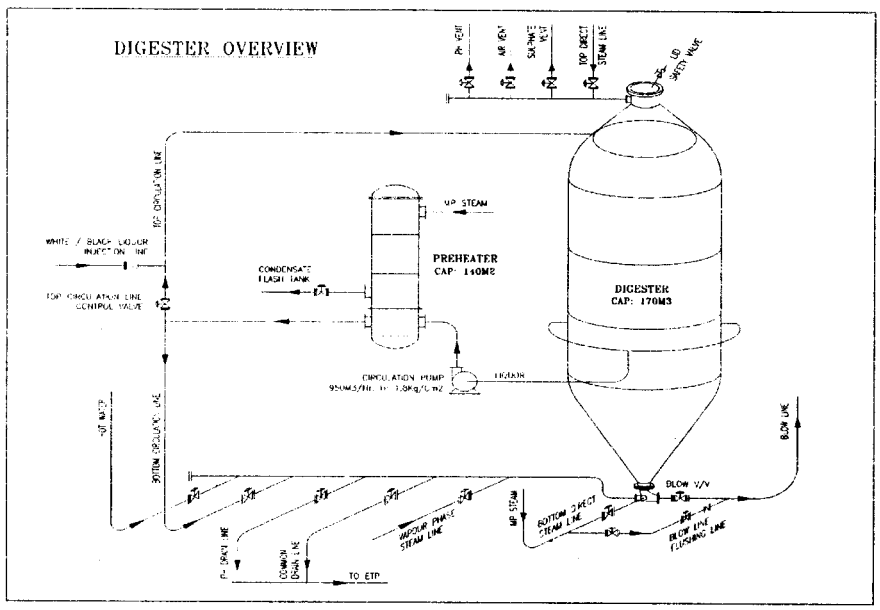

Table 1

Digester Cooking cycle comparison

S.no	Activity	Water phase Prehydrolysis	Vapour phase Prehydrolysis
1.	Chips Loading + Hot Water charging	45	45
2.	Hot water Draining	Nil	15
3.	PH Steaming to 164°C	120	75
4.	PH Cooking at 164°C	75	60
5.	PH Venting & PH draining	60	45
6.	White Liquor charging	30	30
7.	Sulphate Steaming to 163°C	90	90
8.	Sulphate Cooking at 163°C as per G-Factor	60	30
9.	Sulphate Venting	15	15
10.	Blow & Lid open	45	45
	Total time (in min)	**540**	**450**

Table 2

Comparison Analysis

S.no	Prehydrolysis	Parameters Prehydrolysis	Water phase Vapour phase
1.	Cycle time per batch	9.00 hrs	7.30 hrs
2.	No of cooks / Day achieved	21/22	24/25
3.	ETP load:		
	1). Ph liquor drainage per day	800-850 m^3/hr	15-20 m^3/hr
	2). COD load (ppm)	70000-80000	10000-12000
4.	Pentosan content in UB pulp	Inconsistent	Consistent
		2.5 – 4.2	2.5 – 4.2
5.	MP.Steam consumption per cook (tons)	42	45
6.	AA Charge per ton of pulp (kgs)	470	540
7.	Steam Condensate recovery (%)	46	35
8.	ETP treatment cost/ton of pulp produced	Rs.84 /-	Ra.28 /-

digesters since last 3 years and no of cooks from digesters has increased from 21/22 to 24/25 per day.

RESULTS

The results were found encouraging with the following advantages

1. Elimination of high BOD/COD Pre hydrolysate liquor from Digester House thus, reducing pollution load to ET plant.
2. Increase of black liquor solids from 2.1to 2.4 tons/ton of pulp. Thus making the process energy efficient.
3. Reduction of digester cooking cycle time by 90 min resulting in increased productivity.
4. Improved quality of final dissolving grade pulp with consistent final Pentosans content in sheet.
5. Reduction of hot water usage for Prehydrolysis 45-50 m^3/cook.

DEMERITS

1. Heavy hammering in bottom and top headers of digesters causing frequent gasket Failures.
2. Higher active alkali requirement to neutralize prehydrolysate liquor in digesters
3. Low steam condensate recovery.

CONCLUSION

Today, we have totally eliminated the process of water phase pre hydrolysis in cooking process and successfully operating Vapour phase pre hydrolysis. The advantages of reduced pollution load at sources, reduced coal consumption, high productivity and consistent quality are being accrued on sustained basis, making plant ecofriendly

REFERENCES

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