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## Introduction

In order to prepare high alpha cellulose pulp suitable for rayon manufacture the wood should be prehydrolysed with water or with a suitable mineral acid and then digested by conventional kraft process. The purpose of prehydrolysis is to remove pentosans to the maximum extent possible, since the hemicelluloses content of the rayon grade pulp presents the following difficulties :--

- Wood hemicelluloses have low degree of polymerisation (below 200) and therefore they weaken the rayon produced.
- 2) Hemicelluloses cause a great difficulty during xanthation process because they react more easily than the cellulose with both alkali and carbon disulfide. They also form a covering sheath over the cellulose and thus do not allow the cellulose to react uniformly with the chemicals.
- Owing to the presence of hemicelluloses, cellulose fibres are partially dissolved or remain undissolved and therefore cause troubles during the

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# Kinetic and Mechanism of Water Prehydrolysis of Eucalyptus hybrid

The kinetics of the mechanism of water prehydrolysis of eucalyptus wood chips have been studied. Water prehydrolysis is the first stage of treatment to the wood chips for production of rayon grade pulp. The object of the treatment is to remove hemicelluloses which is detrimental for rayon pulp.

The effect of time, temperature and liquor chips ratio in optimising the yield of rayon grade pulp has been studied. By increasing the prehydrolysis time to 120 minute at 170°C nearly 74% of the total pentosans could be removed and the yield of prehydrolysed chips was 75.5%.

filtration of the viscose by clogging the filtering medium.

Generally the prehydrolysis is carried out at high temperature 150 to 180°C for 1-4 hours. Acids generated during prehydrolysis lower the pH value to 4 or below. The action of water on wood under the conduions of treatment is primarily that of hpdrolytic degradation. The water soluble components of wood are completely removed. This treatment is highly effective in the removal of pentosans More of carbohydrates than lignin are removed, by this process-prehydrolysis also helps in the removal of non-cellulose matter soluble in ether. dilute mineral acids are If used for prehydrolysis then the temperature is usually kept at 120-140°C and the time is also shorter than in the case of water prehydrolysis.

#### Objective of the work

The present project work was undertaken to study the mechanism of water prehydrolysis process of *Eucalyptus hybrid*. During the prehydrolysis the effect of time, temperature and liquor material ratio were studied so as to obtain the optimum process variables where maximum pentosans are removed.

### **Raw Material**

The raw material used for all the laboratory experiments is *Eucalyptus* hybrid from M.P. The logs were chipped and screened in Cellulose and Paper Branch's Paper Mill. The screened chips were used for these experiments.

### Experimental

#### Proximate Chemical Analysis

The wood dust passing through 80 mesh and retained on 60 mesh was used for proximate chemical

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analysis employing Tappi Standard Methods. The results of analysis are recorded in Table I.

Table–I Proximate Chemical Analysis of Eucalyptus hybrid

Alcohol Benzene solubility	2.1%
Pentosans	15.2%
Lignin	28%
Holocellulose	71%

## **Prehydrolysis Cook**

About 300 grams of air dried chips of uniform size were charged into a stationary digester of 2 litre capacity with calculated amount of water. The digester was heated by means of bunsen burners to the required temperature. The temperature was kept constant by adjustir g the flames of burners. After the cook was over the chips were taken out and air dried and weighed to find out the yield.

## Preparation of sample for pentosan analysis

The air dried chips were pulped in a refiner keeping the distance between the discs at 4 Mils. The pulp thus obtained was passed through a screen to remove the fines and air dried. The air dried pulp was then taken for pentosan analysis according to Tappi standards.

## Results

The results of proximate chemical analysis are recorded in Table I.

The effect of time variation at maximum temperature level 170°C,

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temperature variation at 5:1 wood to liquor ratio, and wood to liquor ratio variation at 150°C on rate of removal of pentosans is des-

cribed in Tables 2. 3 and 4. These results have been represented in figures 1 to 6 respectively.

Table-11						
Effect of	Prehydrolysis	<b>Fime on</b>	Pentosan	Removal		

Sl. No.	Time at 150°C, min	% yield	% of pentosans on residue	% pentosan removal
1.	15	94.8	12.6	20.6
2.	30	92.2	11.3	30.5
3.	60	88.3	8.3	51.3
4.	90	84.4	6.7	62.6
5.	120	75.8	5.4	73.3

Prehydrolysis Temperature-150°C.

Liquor material ratio-5:1

Time to obtain maximum temperature -90 mts.

#### Table-III

Effect of Temperature on pentosan removal.

SI. No.	Temp. °C	% yield	% pentosans on residue	% pentosan removal	
1.	120	96	12.5	20	
2.	130	94.7	11.8	26	
3.	140	93.3	9.8	39.2	
4.	150	88.2	8.3	51.3	•
5.	160	78.3	7.4	61.28	
6.	170	75.5	5.2	74	

Wood to liquor ratio = 1:5

Time to max. temp. : 90 mts.

Time at max. temp. : 60 mts.

Table	-IV
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Effect of li	quor materia	ratio en	pentosan	removal
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<b>S</b> I. No.	Liquor material ratio	% yield	% of pentosans on residue	% pentosan removal
1.	3:1	90.4	9.5	46.6
2.	5:1	89.1	8.7	48.6
3.	5:1	88.3	8.3	51.3
Te	mp:150°C		· · ·	
Tir	ne to $150^{\circ}C =$	=90 mts.		
Tir	ne at 150°C=	60 mts.		





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Fig. 4-Effect of Temperature on Yield.



Fig. 6-Effect of Liquor to Material Ratio on yield.

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## Discussion

It was observed that as the prehydrolysis time was increased from 30 mts to 120 mts, more pentosans were removed while the yield decreased steadily. At a loss of one fourth of wood three fourth of pentosans were removed in 90 mts. of time at temperature level of 170°C. This aspect is of considerable interest in looking for optimum conditions for prehydrolysis stage rayon pulp preparation. It was also observed that by decreasing the temperature the pentosan removal also decreased under otherwise constant conditions. The wood liquor ratio did not have very much effect on pentosan removal.

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