# Beating Characteristics of Bamboo Pulp in Valley Beater : Effect of Temperature and Consistency on Power Consumption and Pulp Sheet Properties

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*To develop proper fibre to fibre bonding during the course of sheet formation it is imperative to control the degree of beating by controlling the temperature and consistency during the beating process. It is also of interest to interrelate the effect of temperature and consistency with the power requirement.*

## Introduction

It is common knowledge that the temperature of the stock increases appreciably during beating operation due to conversion of energy of motion and friction to thermal energy. It is not uncommon to find the temperature of pulp as high as 60°C at the end of beating process.

High consistency of the pulp during the beating process gives greater fibre to fibre friction resulting in the mechanical treatment of the whole surface of the fibre and thereby reducing the fibre cutting and increasing the fibre flexibility. Higher flexibility of the fibre increases fibre to fibre bonding which affects not only the strength properties of the paper but also its other properties like bulk, sheet formation etc.

With these ends in view, bamboo pulp was beaten in valley beater

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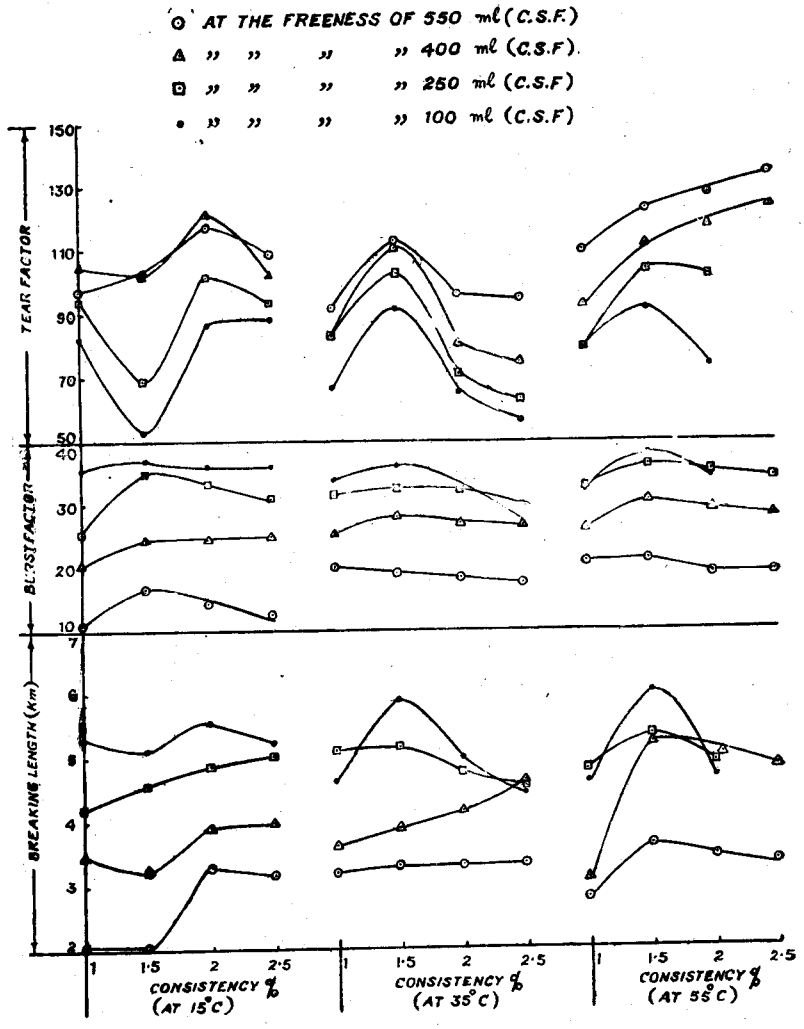


FIG. 1 EFFECT OF CONSISTENCY AND TEMPERATURE OF BEATING BAMBOO PULP IN VALLEY BEATER ON PHYSICAL STRENGTH PROPERTIES

varying temperature and consistency of the stock.

**Results and Discussion**

The bleached bamboo pulp from Central Pulp Mill was beaten in Valley beater at 15°C, 35°C and 50°C keeping the consistency of the stock at 1.0%, 1.5%, 2.0% and 2.5%.

An arrangement to heat the Valley beater was rigged up. The temperature was achieved by circulating the water at controlled temperature through a copper pipe (1½" diameter) immersed in the pulp. The position of the pipe was adjusted so as not to obstruct the flow of the pulp in the beater.

Standard sheets of about 60 g.s.m. were made at 550, 400, 250 and 100 ml. (C.S.F.) freeness and were dried using plates and rings. The sheets were conditioned at 25°C and 65% R.H. and were evaluated for physical properties.

In figure–1, physical strength properties i. e. breaking length, burst factor and tear factor have been plotted against consistency at various freenesses and temperatures. It is seen that at the same consistency breaking length and burst factor are higher at lower freeness while the tear factor is higher at higher freenesses. While in case of tear factor there is marked improvement at high consistency and high temperature, there is no appreciable improvement in burst factor and breaking length.

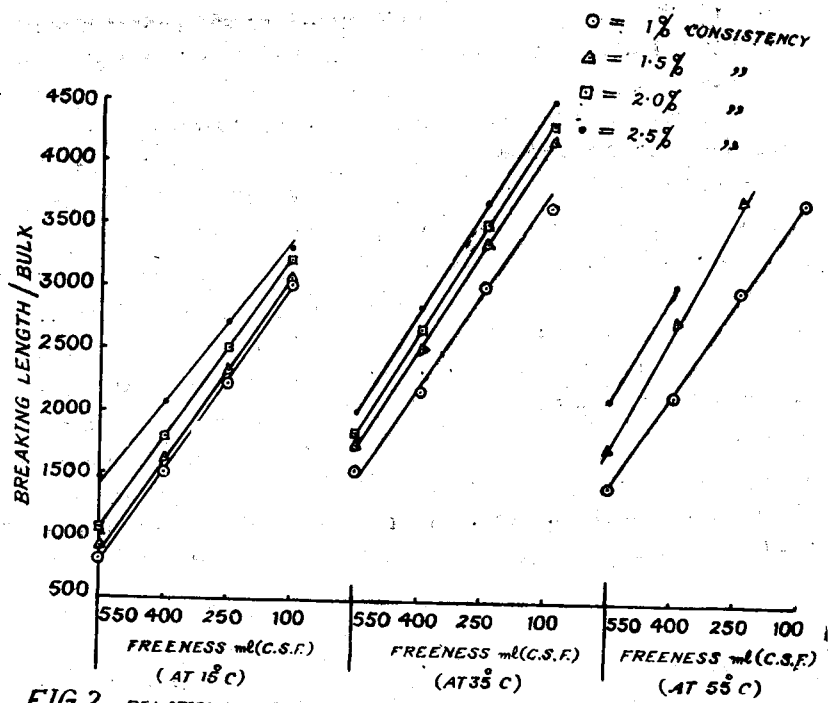


FIG.2 RELATIONSHIP BETWEEN FREENESS AND SHEET PROPERTY OF BAMBOO PULP BEATER IN VALLEY BEATER.

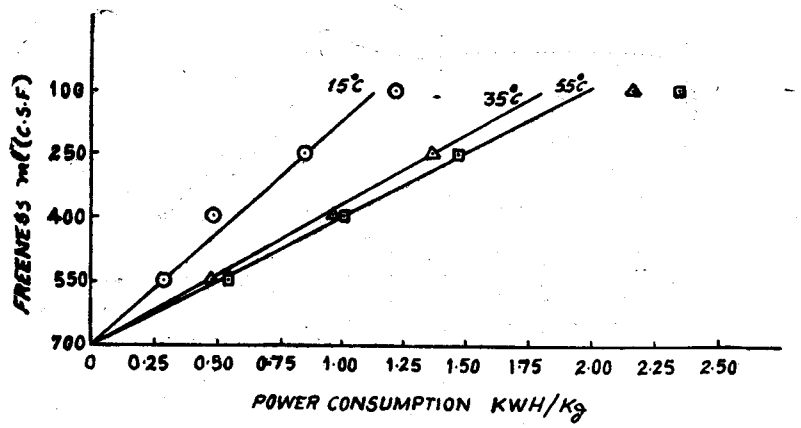


FIG. 3. RELATIONSHIP BETWEEN FREENESS AND POWER CONSUMPTION AT VARIOUS TEMPERATURES AT 1·5% CONSISTENCY IN VALLEY BEATER.

It is also observed that breaking length and burst factor are optimum at 1.5% consistency at all temperatures between 15°C to 55°C while the tear factor does not show any trend.

In Figure–2, breaking length/bulk is plotted against freeness at different temperatures and consistencies. It is clear from the graph that whatever are the temperature and consistency, the relationship is linear and the slope of the line is almost

constant. It is also observed that higher the consistency higher is the ordinate. There is a rise in the ordinate from 15°C to 35°C after which it tends to fall.

The slope of the line may perhaps reflect the inherent interfibre bonding characteristics of the pulp. The variation in the ordinate of the lines is due to the differences in temperature and consistency.

It can be observed that 35°C is the optimum temperature for beating bamboo pulp.

In Figure–3, power consumption has been plotted against freeness at various temperatures at 1.5% consistency (optimum consistency as described above). It is seen that the relationship is linear. It is also seen that power consumption is more at higher temperatures at same consistency.

In Figure–4, power consumption has been plotted against freeness at various consistencies at 35°C (optimum temperature as described above). It is seen that the power consumption is less at higher consistencies.

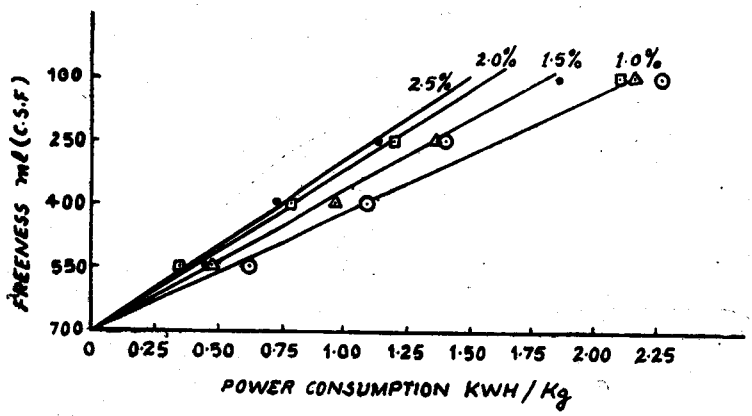


FIG. 4. RELATIONSHIP BETWEEN FREENESS AND POWER CONSUMPTION AT VARIOUS CONSISTENCIES AT 35°C IN VALLEY BEATER

**Conclusions**

Under the conditions, studied:—

(i) From point of view of strength, the optimum-temperature for beating bamboo pulp is 35°C and the optimum consistency is 1.5%.

(ii) There is always a linear relationship between breaking length/bulk and freeness. Temperature and consistency do not affect this linear relationship. The slopes of these lines is almost the same though the ordinates are different. This slope may perhaps reflect the inherent interfibre bonding characteristics of the pulp.

(iii) Power consumption is more at higher temperature (same consistency being maintained).

(iv) Power consumption is less at higher consistencies (same temperature being maintained).