Studies on the Wet Web Properties of some Indigenous Pulp

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Effect of variables like dryness beating, basis weight and pressing on the wet web properties of kraft and high yield pulps from bamboo and mixed hardwoods were examined. Role of fines on the wet web properties of bamboo kraft and CTMP pulps has been discussed. It was observed that the fines very significantly influenced the wet web strength properties of kraft and CTMP bamboo pulps. Removal of fines resulted in 35-50% reduction in the wet web tensile strength of the pulps. Detailed studies on the effect of different fibre fraction on the wet web properties of high yield CTMP bamboo pulp showed that optimum combination of long and short fibre fractions could result in considerably high wet web strength properties of bamboo pulps These studies can provide some guide lines on the refining of high yield pulps from bamboo for getting improved runnability on the paper machine. It is shown that the knowledge of wet web properties is useful in diagnosing the causes of poor wet end runnability in open draw paper machines i e wet web strength determination may be used as a quality control tool for dealing with runnability problems.

Wet web breaks at the couch frequently present a serious operating problem on open draw paper machines. An understanding of factors contributing to these breaks is useful when wet end runnability problems are encountered In the region of couch, the newly formed paper web is heavy, moist and weak Tensions must be applied to the web to transfer it from couch to press This force is obtained by driving the press section faster than the couch. This stretches or draws the web, thus introducing the necessary tension. If wet end breaks are to be avoided, the web must be strong enough to withstand the tension without damage. In order to strengthen the wet web, the factors affecting the wet web strength are to be studied in detail.

Most of the work on wet web studies has been reviewed by Mordon and Short.[1] Effect of different ground wood fractions on wet web strength has been studied by many workers([2]—[5] Effect of fines on wet web strength was studied by Corson and Lobben[6] Effect of fines on sheet properties of high yield sulphite pulp was studied by Nakano & Co-workers [7] (7). Survey of literature indicates that the studies so far carried out are based on eucalypt, pine and spruce pulps. There is no literatures available on indigenous pulps. The present studies were, therefore initiated with the following objectives ;

To find : (i) the role of beating, dryness, grammage and pressing on wet web properties of bamboo and mixed hardwood pulps;

(ii) to study the effect of fines on wet web behaviour of kraft and chemithermo-mechanical bamboo pulp, and

(iii) to Study the effect of different fibre fractions on wet web properties of CTMP bamboo pulp.

EXPERIMENTAL :

Unbleached and bleached kraft pulps from bamboo and hardwoods were prepared in the laboratory series digester. CTMP and TMP pulps of bamboo were made in the TMP pilot plant of the Institute.

Beating of the pulps were carried out on PFI mill as per ISO DP 5264, Wet web determinations were done on L &W wet web strength tester according to Scan-31:37, with a modification that instead of 25% dryness, we have adopted 20% dryness as per Indian conditions prevailing in the opendraw paper machines.

To study the relative fine contribution to wet web properties of unbleached bamboo kraft pulp, fibres of varying qualities were obtained by beating the pulp in PFI mill to 180 ml CSF and then fractionating in Bauer Mc Nett classifier using 100 mesh screen under standard conditions. The material passing 100 mesh screen is considered as fine fraction for chemical pulps and only the fractions retained on 100 mesh is collected for studies. Effect of fines on wet web properties

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were studied by comparing the properties of whole pulp and fractions retained on 100 mesh.

Effect of fines on high yield pulps was studied by beating the pulp to 165 ml CSF level and then fractionating it using 200 mesh screen under standard conditions. The (+200) fraction was collected and its wet web properties were determined. The wet web properties of whole pulp were also determined.

In another set of experiments large quantities of CTMP bamboo pulps were refined in PFI mill to 165 ml freeness level and fractionated using 28, 100 & 200 mesh screens. The fibre fractions were designated as.

R28	—	Retained on 28 mesh — long
P_{28}/R_{100}	—	Retained on 100 mesh — medium
P_{100}/R_{200}	—	Retained on 200 mesh — short
P_{200}	—	Passing 200 mesh — Fines.

Fourteen blends were prepared using the three fractions R_{28}, P_{28}/R_{100} and P_{150}/R_{200} and their wet web properties were determined. Fractions passing 200 mesh screen could not be collected.

RESULTS AND DISCUSSIONS :

Beating increased the wet web strength and elongation of bamboo and mixed hardwood kraft pulps. The wet web elongation (expressed as TEA index) of bamboo pulp at any freeness level was comparatively higher than mixed hardwood pulps. There was no significant increase in the wet web strength of CTMP bamboo pulp on beating. On the other hand the TEA index has gone down during beating.

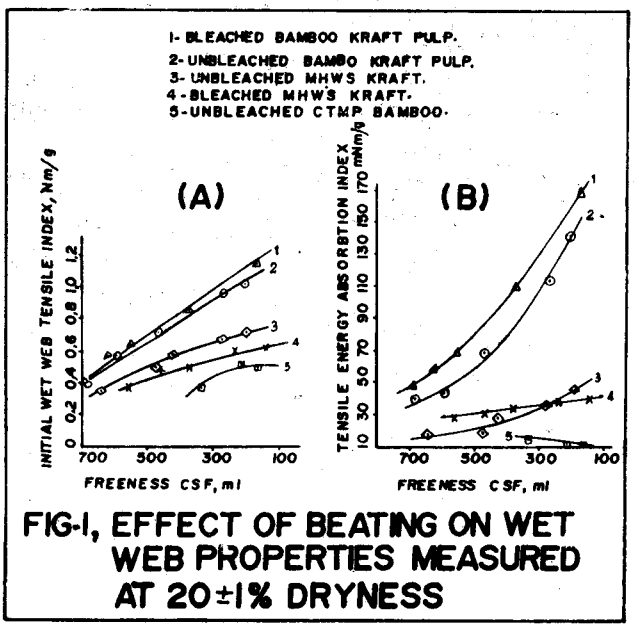

FIG-1, EFFECT OF BEATING ON WET WEB PROPERTIES MEASURED AT 20±1% DRYNESS

Dryness increased the wet web tensile strength whereas wet web elongation decreased for both bamboo and mixed hardwood kraft pulps.
When compared to bamboo and mixed hardwood kraft pulps, hardwood pulps needed more pressing time for attaining the same dryness.

Grammage has shown a direct influence on wet web strength of bamboo and mixed hardwoods kraft pulp.

With increase in grammage the wet web strength increased when studied at 20% dryness of the wet strip. Linear relationship was obtained between grammage and wet web strength of the pulps tested.

Pressing has increased the wet web strength of unbeaten and beaten bamboo kraft pulp. An increase in pressing load significantly increased the wet web strength of unbeaten less flexible fibres. A relatively smaller effect was observed for beaten long fibre webs. Wet web elongation decreased with increase in pressing load. The same trend was observed with other pulps also.

Fines significantly increased the wet web properties of kraft and CTMP bamboo pulps. The strong influence of fines on the wet web strength of both unbeaten and beaten pulps could be observed in the relative displacement of the curve of whole bamboo pulp and their fibre fractions. The same trend was observed with CTMP bamboo pulp (See Fig. 6 (A to D)). It was shown that by removing the fines fraction the wet web strength of bamboo kraft pulp decreased by 35 to 42% and wet web elongation by 20%. The effect was more pronounced for CTMP bamboo pulp when compared at 30% dryness. Wet web tensile has gone down by 50% or more and wet web elongation by 30% Due to the entanglement of fibrillar fines and interfibre fibrills the frictional forces between fibres increase which improve wet web strength and extensibility.[9] Wet web strength of a fine free pulp mat depends upon the friction between the fibres and the surface tension

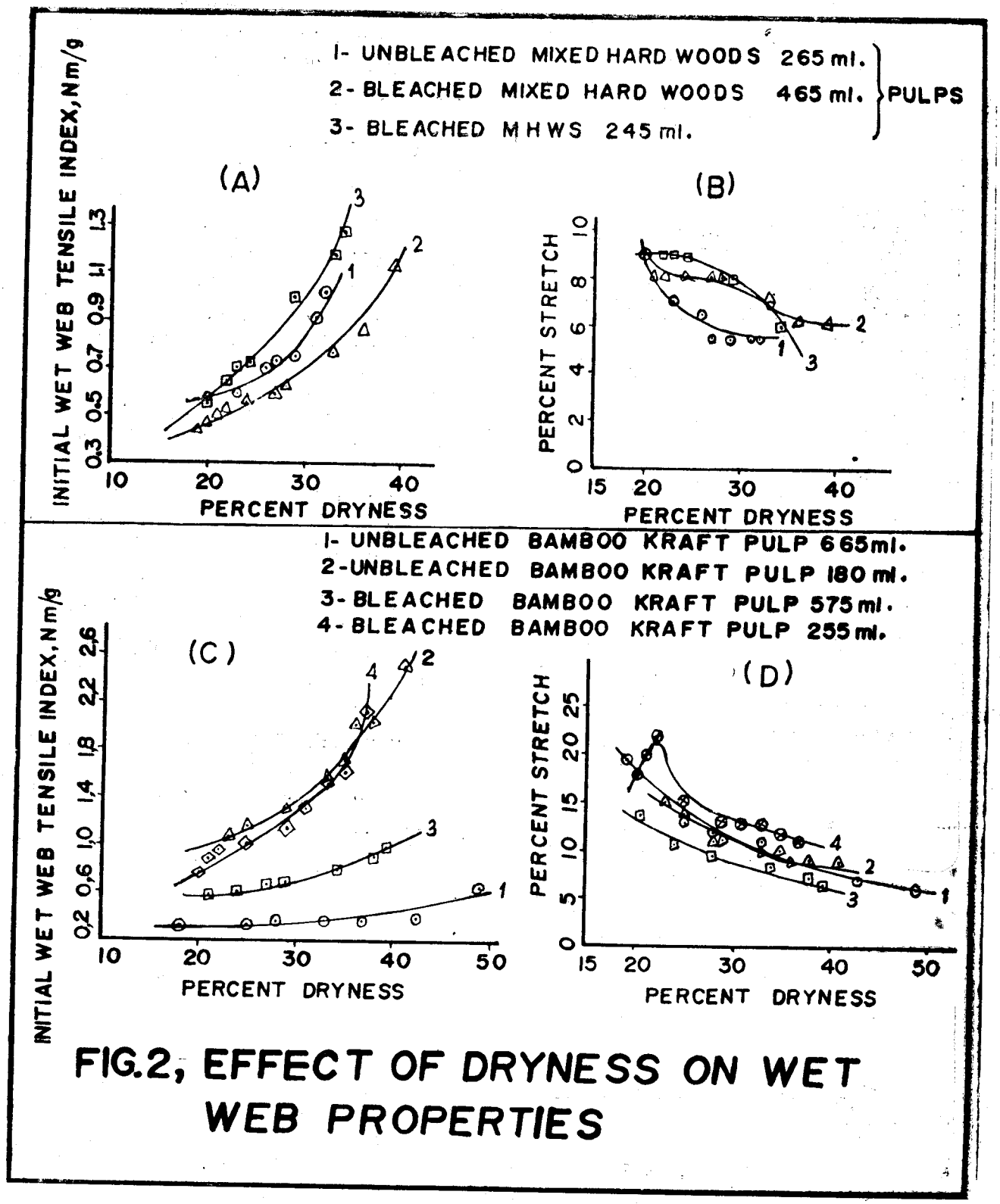

FIG.2, EFFECT OF DRYNESS ON WET WEB PROPERTIES

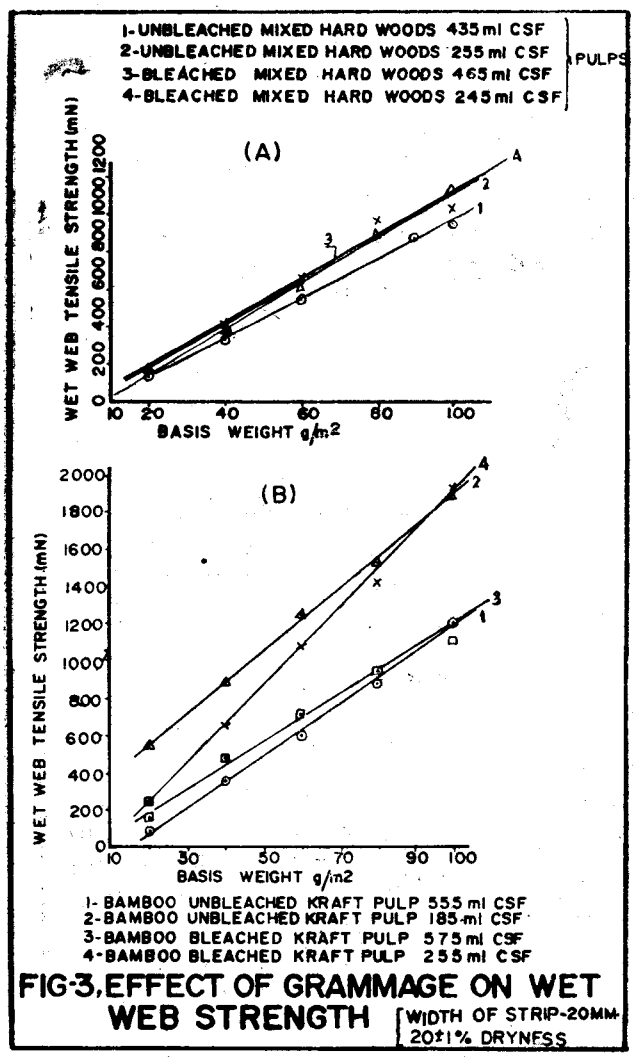

FIG-3, EFFECT OF GRAMMAGE ON WET WEB STRENGTH [WIDTH OF STRIP-20MM. 20±1% DRYNESS

of water adhering to the fibres. The friction between the fibres increases with increase in fibre entanglement. When fines are added they fill up the voids left by the entangled fibres thereby creating more friction between the fibres. Also fines trap in between the inter fibre fibrills which will also increase the frictional forces between the fibres thereby increasing the wet web strength.

Influence of different fibre fractions on wet web properties has been examined for unbleached CTMP bamboo pulp. Keeping the long fibre fraction constant and varying the medium and short fibre fractions, the wet web tensile and elongation increased with increase in short fibre fractions. This proves that the medium fibre fraction has negative influence on the wet web properties of CTMP bamboo pulp.

Keeping the medium fraction constant and simultaneously varying the long and short fibre fractions, the wet web tensile increased with increasing the long fibre fractions, upto 70% and then decreased with further increase in long fibre fractions.

Wet web elongation has gone down with increase in long fibre fraction and simultaneously decreasing the short fibre fraction.

It could be concluded that by increasing the long fibre fraction wet web properties as a whole could not increase and pulp of higher freeness value results which will give a drier sheet under constant dewatering conditions which inturn will result in higher wet web tensile strength.

CONCLUSION

1. Wet web tensile strength of unbleached and bleached kraft pulps from bamboo and mixed hard woods increased with beating Elongation properties of bamboo kraft pulp increased sharply with beating. Beating did not show any significant increase in the wet web tensile strength of high yield pulp from bamboo whereas wet web elongation has gone down.

2. Increasing the dryness the wet web tensile strength of bamboo and mixed hard woods pulp increased whereas elongation decreased.

3. Linear relationship was observed between basis weight and wet web tensile strength for all the pulps tested.

4. Pressing increased the wet web tensile strength of kraft and high yield pulps but applying higher amount of pressing did not show any influence on wet web strength.

5. Fines fraction does make an important contribution to wet web properties.

6. Optimum combination of long fibre fraction and short fibre fraction could result in attaining very high wet web strength. Medium fraction shows negative influence on wet web proprties.

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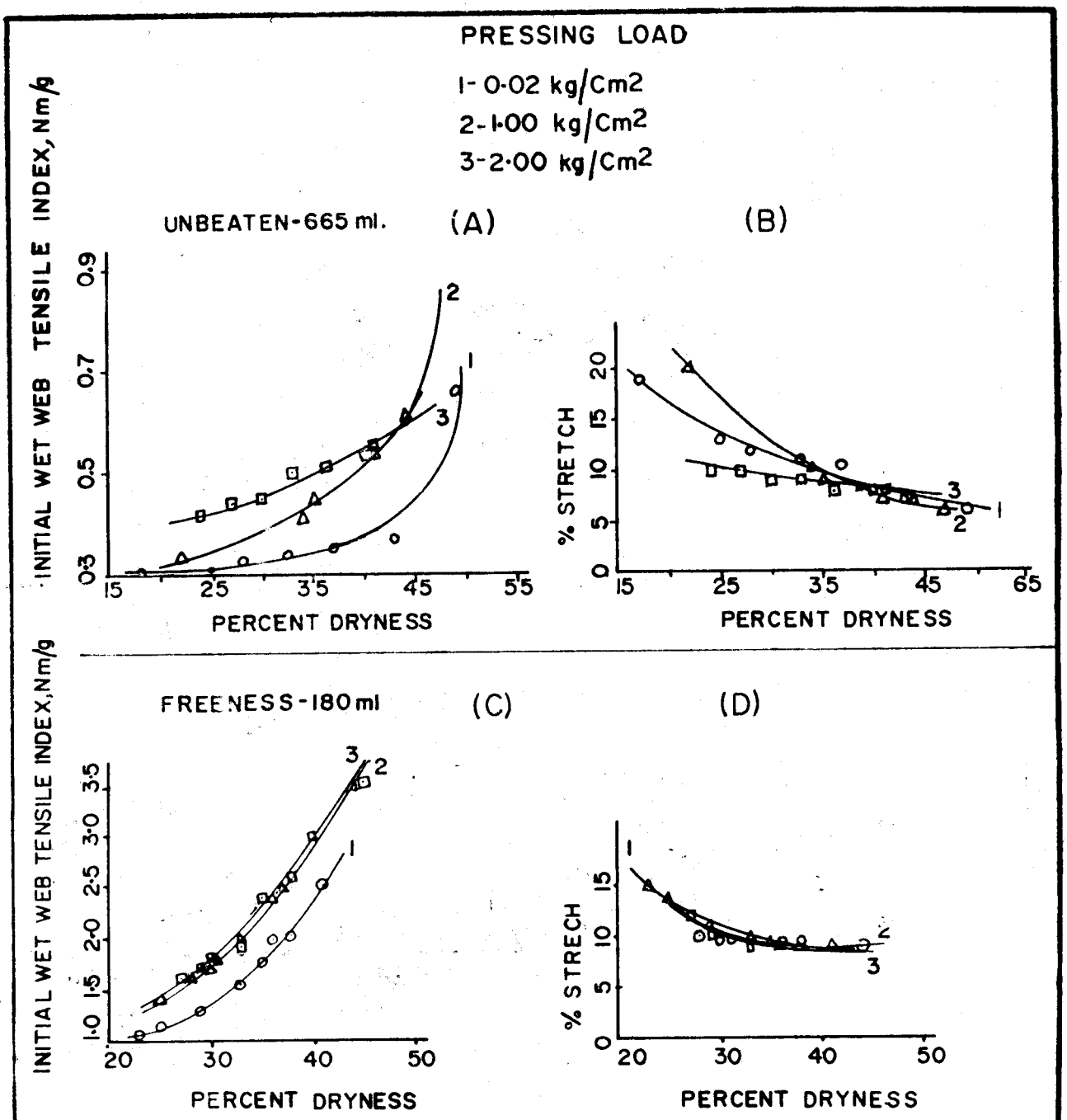

FIG-4, EFFECT OF PRESSING ON WET WEB PROPERTIES OF UNBLEACHED BAMBOO KRAFT PULP

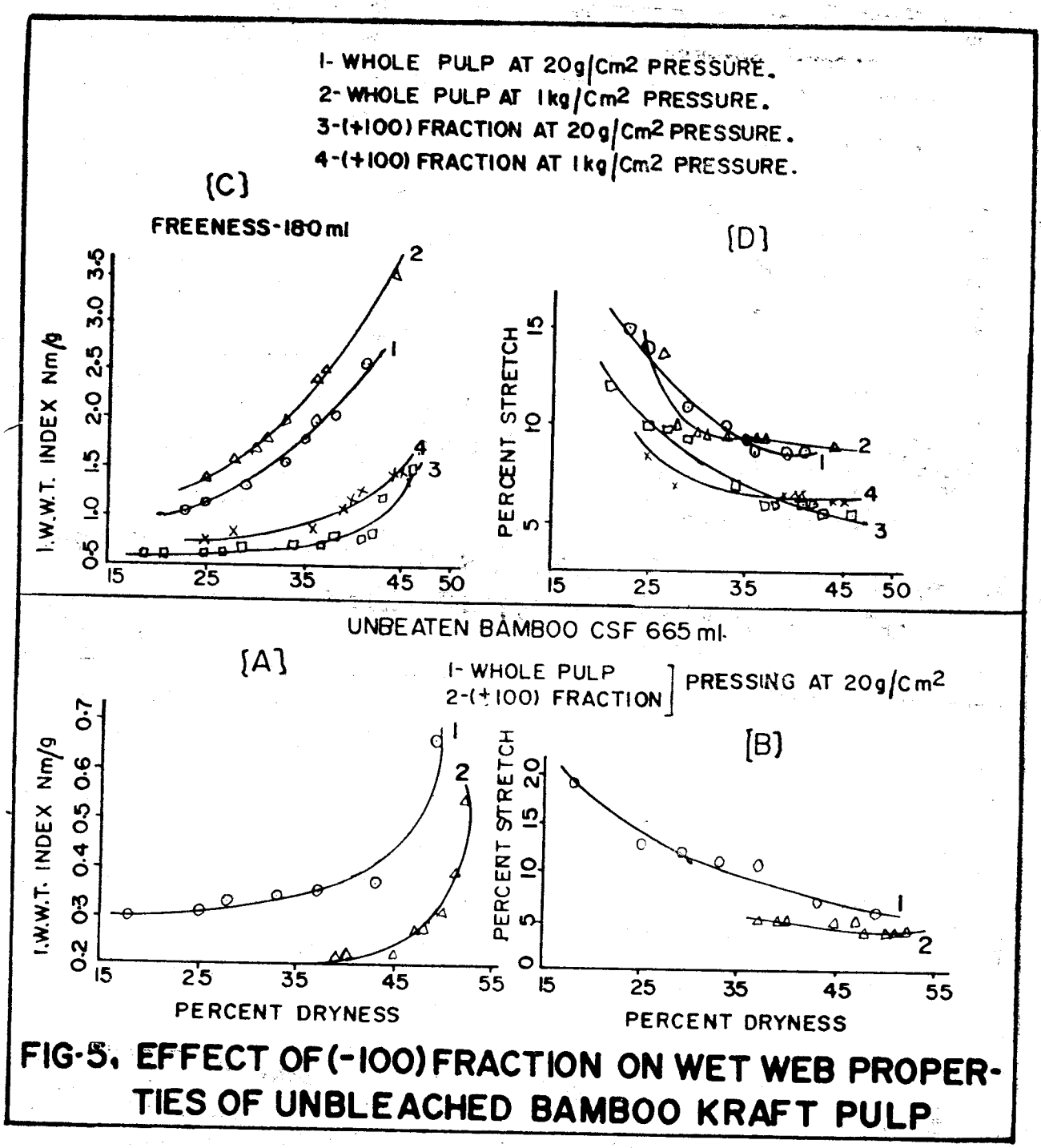

FIG-5. EFFECT OF (-100) FRACTION ON WET WEB PROPERTIES OF UNBLEACHED BAMBOO KRAFT PULP

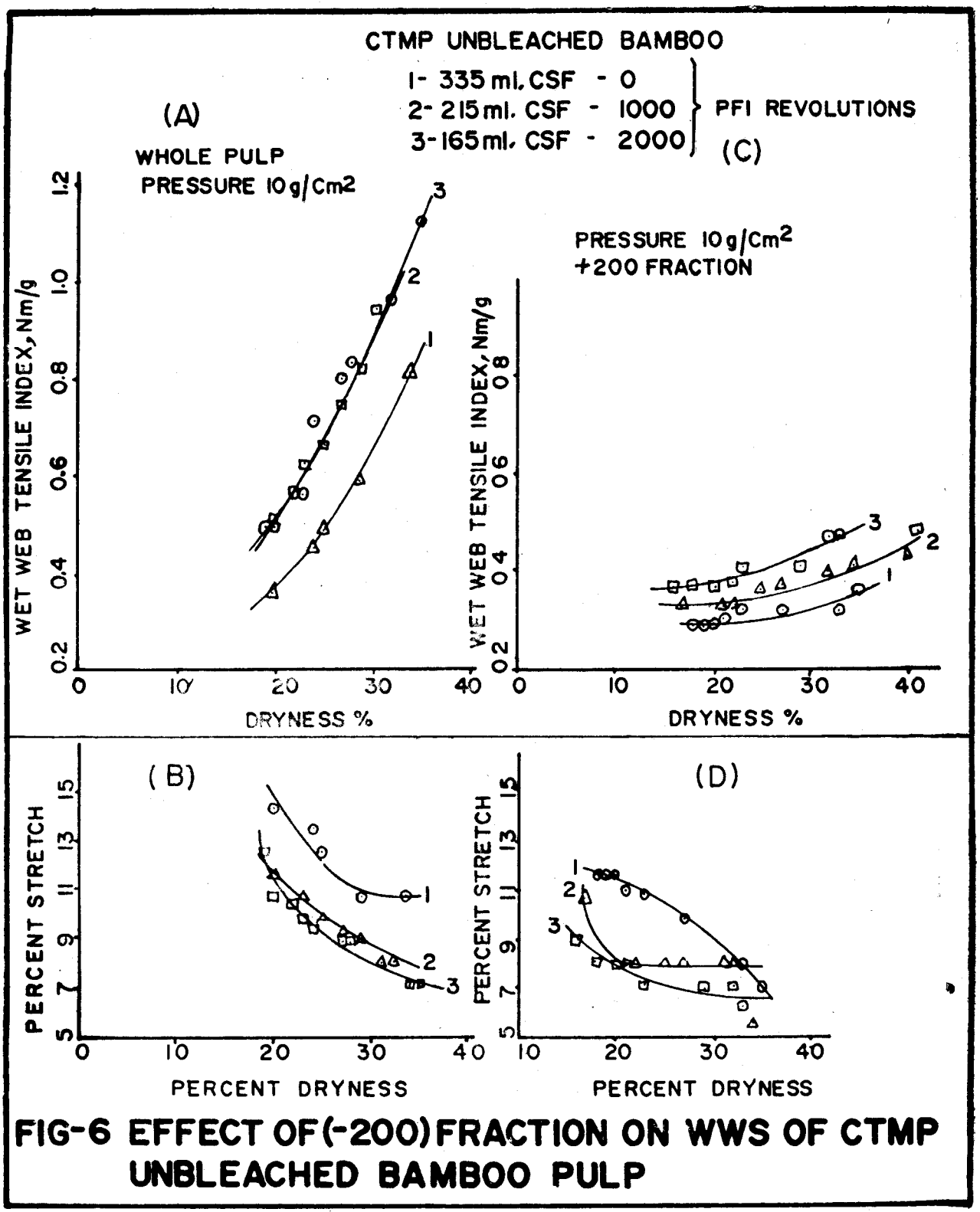

FIG-6 EFFECT OF (-200) FRACTION ON WWS OF CTMP UNBLEACHED BAMBOO PULP

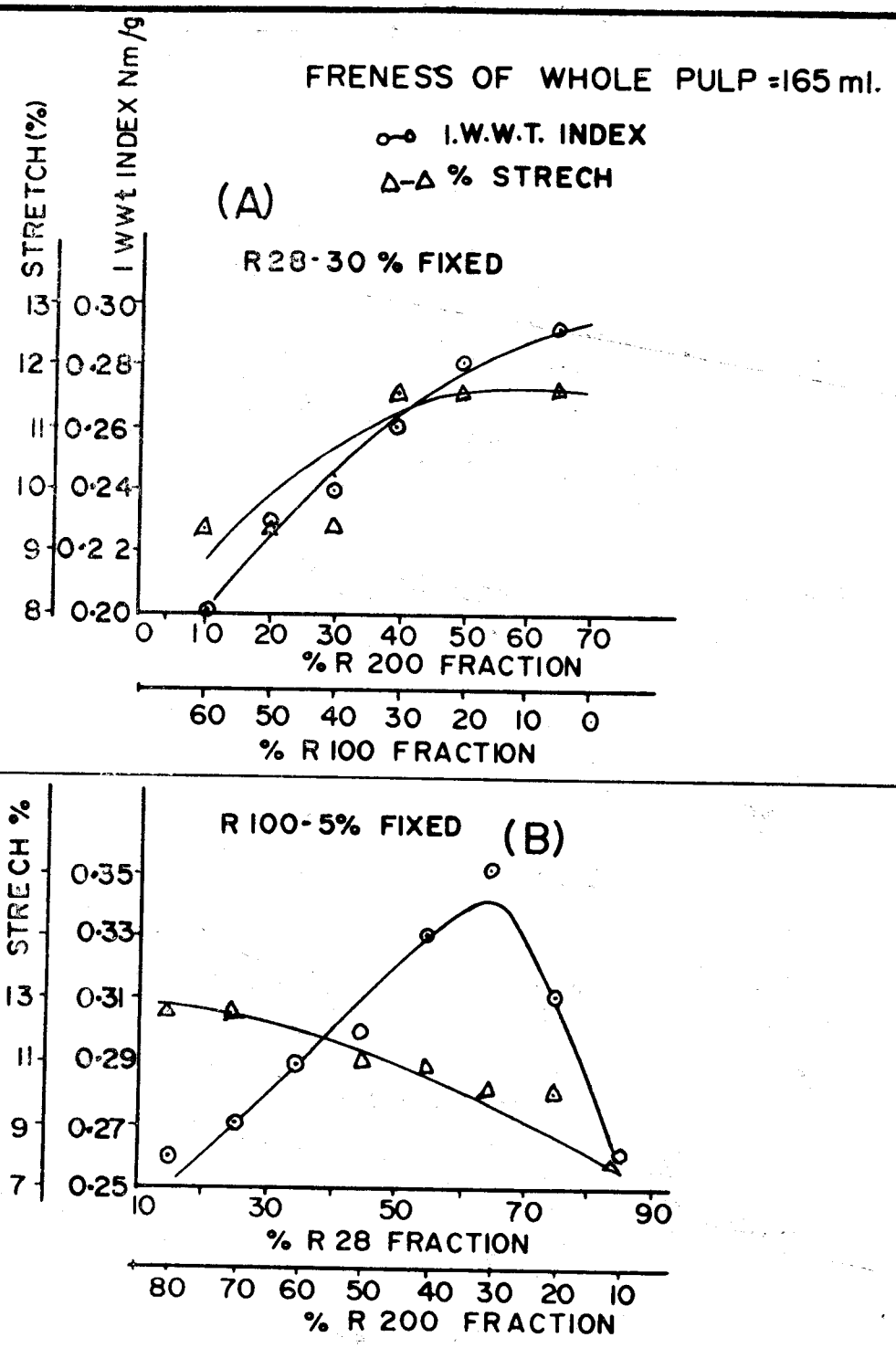

FIG-7, EFFECT OF DIFFERENT FIBER FRACTIONS ON WET WEB STRENGTH OF CTMP UNBLEACHED BAMBOO PULP

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