THE SUITABILITY OF THE ROD MILL IN BEATING COTTON LINTER PULP

By
W. H. Swanson¹
and
G. H. Chidester²

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Introduction

Preliminary beating trials in the rod mill have shown that rapid hydration without much cutting of the fibers can be obtained on sulphite and kraft pulps. An opportunity for studying the effect of the mill on beating the very "free" cotton linter pulp was afforded through the cooperation of a large cotton oil company in Tennessee.

Equipment

The semicommercial rod mill installed at the Forest Products Laboratory was used in the tests. It is 3 feet in diameter, 5 feet long, inside measure, and rubber lined. The rods are of steel, 3 inches and 2-1/2 inches in diameter and 4 feet 8 inches long. The total weight of rods was 3700 pounds. Rotating speeds of 28 r.p.m. and 18 r.p.m. were used during the tests.

The rod mill is normally operated continuously. The ends are open and the pulp is fed in by a screw conveyor. In order to simplify the study of the effect of beating time and consistence, the ends of the mill were blocked, and the tests run on the batch system similar to a ball mill beating test.

Material

The cotton linter pulp used in the trials was dried and pressed in bales.

¹Formerly Associate Chemist in Forest Products, Forest Service, U.S. Forest Products Laboratory, Madison, Wis.
²Assistant Engineer in Forest Products, Forest Service, U.S. Forest Products Laboratory, Madison, Wis.
Procedure

Three trials were made at consistences of 3.6, 10, and 14 per cent at a speed of 28 r.p.m. A fourth trial was then made at a consistence of 10 per cent at a speed of 18 r.p.m. Machine runs were made of the pulp beaten at 14 per cent at a speed of 28 r.p.m., and at 10 per cent at a speed of 18 r.p.m.

Samples of the pulp were taken from the rod mill at 15 and 30 minute intervals during the beating, and hand sheets were made from these on the Laboratory sheet mold. Mullen pop tests were made on the hand sheets at 65 per cent relative humidity.

Results of Tests

The Mullen tests, made on the hand sheets of the pulp taken from the mill during the tests gave the following results:
The appearance of the hand sheets and the strength curves indicate that the 4 percent and 10 percent pulps were probably left in the mill too long, although the pulp was not greatly hydrated. The 10 percent consistence showed the highest pop test, and the fiber appeared to be cut very short. The pulp beaten in the rod mill after being run over the paper machine, compares with that prepared in the beater as shown in the following table:
The pulp beaten in the rod mill has approximately the same tearing and tensile strength as that prepared in the beater. It is, however, much lower in folding and bursting strength, and stretch. The pulp beaten at 14 per cent at 28 r.p.m., after 3 hours, appears to be still underbeaten, the fiber being neither cut nor hydrated to any great extent. That beaten at 10 per cent is more hydrated, and is cut much shorter. It is probably overbeaten.

The dark color of the rod mill pulp is due to the steel rods. The intermittent operation gives an opportunity for the formation of a comparatively large amount of rust to be taken up by a small batch of pulp. This dark coloring can be prevented by the use of rods of bronze or stainless steel.

The pulp showed a tendency to ball up and form small knots during the beating, especially at the higher consistences.
Conclusions

The results of these tests are not particularly encouraging for the use of the rod mill in beating cotton linter pulp. Hydration was not obtained to any great extent without cutting the fiber, and the pulp prepared in the rod mill appears inferior to that prepared in the usual manner. The pulp beaten for an hour and 45 minutes at 10 per cent consistence and 18 r.p.m., however, would probably have compared favorably with that prepared in the beater, had it been run on the machine.

The pulp prepared in this manner required 0.018 horsepower per pound of pulp per 24 hours as beaten in the small mill. Commercial installations, however, have shown a power consumption of approximately one-third of that for the semicommercial mill in the laboratory.
Rodmilled at 10% consistence

Rodmilled at 14% consistence

Prepared in beater

Cotton Linter Samples