

SD433

514

U52

no. 514

U. S. Department of Agriculture, Forest Service

## FOREST PRODUCTS LABORATORY

In cooperation with the University of Wisconsin

MADISON, WISCONSIN

### CONSUMPTION OF CHEMICALS BY SULPHATE PROCESS

By OTTO KRESS

In Charge Section of Pulp and Paper  
and

CLINTON K. TEXTOR

Assistant Engineer in Forest Products



July 27, 1916

## CONSUMPTION OF CHEMICALS BY SULPHATE PROCESS

----

### A Record of Experimental Work in Pulping Unbarked Wood

By  
Otto Kress  
and  
Clinton K. Textor

----

Round wood used in the production of pulp for the subsequent manufacture of paper is received at the mill either rough in the bark or as peeled or rossed wood. River driven wood has, of course, a great deal of its bark removed, as a consequence of the action of water and the rubbing of the logs against each other.

In the manufacture of sulphite and mechanical pulp, all bark must be removed from the wood before chipping or grinding, if clean pulp is desired. Any fragment of bark that finds its way into the pulp is not destroyed, but is mechanically disintegrated during the process of conversion of pulp to paper and makes its appearance in the finished sheet. The wood is often not cleaned so well in the soda and sulphate or kraft processes because the action of the alkaline cooking liquors tends to destroy the bark.

In the soda process, if the resulting pulp is to be bleached, as, for example, for high grade book stock, any bark left with the chips, which is not completely destroyed by the alkaline digestion, will appear in the finished sheet and detract from its appearance and market value. Certain other grades of soda pulp are made in which the stock is not bleached and for which the wood does not have to be so thoroughly cleaned.

The kraft or sulphate process, while the latest developed of the chemical pulping processes, is making rapid strides in increase in tonnage. We often find that the wood used is not completely barked and in some cases no treatment is given. Further, decayed or burnt sections of the log are often chipped along with the sound wood. This probably is due largely to the fact that the bulk of the kraft paper is sold either in the natural brown color or only shaded by dyestuffs to some shade of brown. Wood which has not had bark, knots, decayed or burned sections properly cleaned from it will produce pulp varying in color, depending upon the amount of these materials present, even if pulped in the same digester and under similar pulping conditions.

Some of the kraft mills in the South operating on yellow pine, bark their wood, while others, believing it



cheaper to use some extra alkali, pulp wood and bark together. In order to determine the amount of chemical required, pulping tests were run on a mixture of wood and bark such as is ordinarily used at one of the Southern paper mills, and also on clear bark to determine the amount of chemical required to reduce the bark.

The wood was shortleaf pine, received at the mill in two-foot bolts in the bark. After chipping and screening the chips are carried to the digester chip-loft; the shipment sent to the laboratory was taken at this point. The bark of the shortleaf pine, similar to the bark of all yellow pines, is very brittle, and the various mechanical treatments of chipping, disintegrating and screening threw out a large proportion of the bark in the form of dust and small pieces.

A determination made upon a 10-pound sample showed a composition of 96 per cent wood and 4 per cent bark on the bone-dry basis. One hundred pounds of this mixture was pulped in a 63-gallon iron digester supplied with direct and indirect steam. The cooking conditions used were those found best for longleaf pine. The total time of cook was three hours and ten minutes at a maximum pressure of eighty pounds, and the charge was blown

into the blow pit at that pressure. On the bone-dry basis of 96 pounds of wood and 4 pounds of bark, 12.85 pounds of caustic soda and 4.76 pounds of sodium sulphide were required per 100 pounds of this mixture.

After draining and washing the pulp in the blow pit to free it from black liquor it was placed in a strong linen bag enclosed in a perforated iron container and pressed under a 70-ton, knuckle joint power press. This left the pulp about 30 per cent dry, and it was then opened up in a swing hammer type shredder and sampled for total yield. The pulp was then opened up in a 40-pound Marx beater and pulped to a 6-plate diaphragm screen with 0.009 inch slots. The screenings which went over the plates were sampled and the weight subtracted from total yield to give yield of screened pulp.

The screened pulp was concentrated and beaten two hours in a 40-pound Marx beater and finally run off as paper on a 15-inch Fourdrinier machine.

The yields on the basis of bone-dry weight of wood and bark were 52.5 per cent crude pulp and 7.05 per cent screenings. The finished paper showed a few specks of bark and was a little raw, as indicated by the high yield and low chemical consumption. The paper tested a little weaker

than previous runs on yellow pine, which we believe is due to the slight rawness of the pulp.

The pulp which was not sized was run into a 38<sup>4</sup> pound sheet on the basis of a 24-inch by 36-inch - 500 sheet ream, of an average thickness of .0037-inch. The average Mullen test was 36.1 pounds, giving a strength of .95 points per pound. The average breaking length, stretch, and double folds with and across the machine direction were 5,565 meters, 2.72 per cent, and 619 double folds.

One hundred pounds of clear bark refuse from the same mill was pulped, duplicating as closely as possible the conditions of the previous run on the mixture of bark and wood. Under these conditions, one hundred pounds of bone-dry bark required 28.6 pounds of caustic soda and 10.65 pounds of sodium sulphide. The product showed a yield of 24.9 per cent of a gelatinous brownish-black mass which contained some pieces of unreduced outer bark. An attempt to screen or wash this pulp failed as the material clogged the screen openings. Hand sheets were made of this slimy and very slow stock, which gave all the physical indications of an extremely hydrated stock, the resulting sheets being very hard and parchmentized.

The data given above indicate that in a mixture of 96 pounds of wood and four pounds of bark, the bark



consumed 8.9 per cent of the caustic soda and 8.95 per cent of the sodium sulphide, or that for every ton of wood (figured on the bone-dry basis) 22.9 pounds of caustic soda and 8.52 pounds of sodium sulphide will be used up in the reduction of the bark. Of course the soda, minus that lost in the recovery, is regained, but has to be carried through the evaporation, smelter, and causticization cycle. On the ordinary basis of calculation of 1-1/2 cords of round wood or two cords of slab wood per ton of finished paper, the consumption of extra cooking chemical is quite high, besides offering the difficulty of holding the paper uniform both in shade and strength. Kraft mills should, therefore, be interested in considering the cost of installation, cost of operation, and barking losses of any barking machinery, as compared with the added cost of the chemicals consumed in pulping the bark.