IC RESEARCH CORPORATION OF THAILAND

MISCELLANEOUS INVESTIGATION NO. 27
PRELIMINARY STUDY ON PRODUCTION OF PULP
FROM COTTONSEED HUSK

REPORT NO. 1
BLEACHED LINTER PULP FROM COTTONSEED HUSK

BY
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about 7,000 tonnes of bleached pulp per year from the available cottonseeds in Thailand. Expansion of cotton acreage in the near future will further increase the supply of cottonseeds for both oil and pulp.

MATERIAL

Cottonseed husks were supplied by Industrial Enterprise Co. from their solvent extraction plant, which produces cottonseed oil from local cottonseeds. Cottonseed kernels are extracted from the cottonseeds by a decortication process which cracks the seeds and separates cottonseed husks from seed kernels.

The cottonseed husks contain linters in varying amount depending on the species of cotton. The husks were contaminated with broken seed kernels and cottonseed oil.

EXPERIMENTAL AND RESULTS

(i) Preparation of bleached linter pulp from cottonseed husks

In a laboratory stainless steel tumbling digester, 1000 g of air dry cottonseed husks with linters were cooked for one hour at 100°C with 1.5 per cent sodium sulphide on ovendry husk weight and at liquor to husks ratio 3:1. The cooked husks were washed to remove the deep brownish red waste liquor derived from the dissolved tannin of the husks. The washed husks were pulped in the digester with a fresh solution at liquor ratio 3:1 composed of 1.5 per cent sodium sulphide and 10 per cent caustic soda based on the ovendry husks. The digester was heated to 160°C in one hour and held at 160°C for two hours. The digester was cooled by venting for 15 minutes to about 100°C and opened. The crude pulp appeared brown and contained small particles of husks. This was washed and bleached for 3 hours at 40°C with 3 per cent available chlorine in sodium hypochlorite solution at 5 per cent pulp consistency. The bleached pulp was washed in a 0.5 per cent sulphur dioxide solution for one-half hour at room temperature to remove any residual chemicals and brighten the pulp. The bleached yield was 33.7 per cent on ovendry husks.

(ii) Handsheets from linter pulp

The bleached linter pulp was used in making handsheets of paper. The pulp had an initial S-R freeness of 900 ml. The pulp slurry at 210 ml S-R freeness was prepared by beating at 0.3 % pulp consistency for 16 minutes in a laboratory Hollander beater.

The following internal sizing materials were added:

Whiten*	0.3 %
Methyl violet	0.003 %
Rosin size	1 %
Aluminium sulphate	2 %

The paper sheets produced showed good opacity and softness. For physical tests, the paper sheets were conditioned for 24 hours in a room maintained at 23°C and 50 % relative humidity. All physical tests were done in accordance with TAPPI standard methods. The test results were compared with kenaf pulp and locally made writing paper as shown in Table 1.

TABLE 1
PHYSICAL TESTS OF PAPER

Pulp furnish	Bleached linter pulp 210 ml S-R freeness	Local writing paper from imported wood pulp and waste paper	Bleached kenaf 1/ kraft pulp at 365 ml S-R freeness
Brightness	75.9	75.0	80.0
Basis weight, g/m^2	77.3	59.0	76.2
Breaking length, m	3778	4027	9276
Burst factor	22.6	16.0	45.1
Tear factor	165.5	140.0	99.4
Folding endurance	293	29	304
Density	0.6	0.68	0.80

1/ ASRCT research project 1/17 bleached chemical pulp from Thai kenaf stalks prepared at the laboratory.

* Trade name of an optical brightening agent.

DISCUSSION

Several attempts to digest the cotton husks with neutral sulphite process, soda process, and nitric acid process failed with most black husks remained in the linter. Kraft process with high sulphidity of about 60 per cent appeared effective in digesting husks and separating the linter pulp. The sulphidity can be reduced and bleachability improved by a two-stage kraft process. The first stage is aimed for extraction of soluble matters by a dilute solution of sodium sulphide, which also helps to stabilize the cellulose from alkaline degradation in the second stage kraft pulping.

The sodium sulphide solution containing about 16 % Na_2S was supplied by a petroleum refinery, which produces the solution as a waste from absorption of hydrogen sulphide gas with caustic soda solution. This waste sodium sulphide solution is available at a low cost. This experiment of pulping cottonseed husk illustrates its specific application.

As the amount of caustic soda and sodium sulphide required in the two-stage pulping is rather small, being only 13 per cent in total, recovery of chemicals is unnecessary. The process can be adapted to small integrated pulp and paper mills for production of bleached pulp in view of the simple processes for pulping and bleaching.

Cotton linters have fibre length of 0.8-1.1 mm, and width of 21.0 microns. The lower tensile strength of linter pulp when compared with kenaf chemical pulp is associated with larger fibre cross-section, shorter fibre length, and lower intrinsic fibre strength. On the other hand, the high opacity, good softness, and high tearing strength of linter pulp are good characters for blending with kenaf pulp to improve the quality of paper in respect to opacity, softness, and tearing strength.

CONCLUSIONS

1. Cottonseed husk with linters can serve as a supplementary raw material for pulp. Bleached pulp with 34 per cent yield can be obtained by 2-stage kraft pulping with 13 per cent total applied

chemicals and by single-stage hypochlorite bleaching with 3 per cent available chlorine.

2. As a filler pulp, cotton linter pulp may be useful for its high opacity and softness although lower tensile strength when compared with wood pulp and kenaf pulp.

RECOMMENDATION

1. Most of Thai cottonseeds are for export. The vegetable oil industry of Thailand should make more use of local cottonseeds for solvent extraction of oil and separation of cottonseed husks with linters, which can be utilized by local paper mills for production of pulp and paper.

2. The good softness and high tearing strength of cotton linter pulp are unique and best adapted for the production of toilet tissue paper.

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