De Pithing And Pulping of Kans (Sacchrum Spontanteum) Grass

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ABSTRACT

Pulping of de-pithed kans (sacchrum spontanteum) grass gives higher yield, low kappa no., heigher strength properties and heigher un bleached pulp brightness compared to the undepithed kans grass.

70% ISO pulp brightness can be achieved by EoCH bleaching sequence with only 2.64% active chlorine.

INTRODUCTION

Kans (Sacchrum spontanteum), a non wood plant of gramineae family is abundantly available in some middle and western low land parts of Nepal.

Kans grows from the month of June to october. Cutting of this plant is started by farmers from the month of November. After cutting the plants are allowed to dry in the field for few days then Kans grass are transported to the mill site by trucks and tractors from middle and western low land parts of Nepal. After arrival of kans to the mill, pulp and paper mill enter into contracts with the farmers who organised the storage of grass.

The stem of kans grass are erect, rigid and of tubular structure having a stem diameter of about 3 mm to 9 mm, separated at intervals by node. These intervals are called inter node. The leaf starting at the node forms a sheath part way up the stem. Kans grass have a length of about 1 to 2 meters.

Kans fiber is a short fiber with an average length of 1.6 mm and width of 0.025 mm.

Fiber classification studies were made with the help of Bauer McNett fiber classifier with mesh no. 28, 48, 100 and 200. The results are given below:

Mesh size	Fiber weight %
Unbleached ^{0}SR	25
28	13.6
48	30.8
100	22.6
200	14.7
-200	18.3

It was observed that about 67% fibrous materials are present in kans pulp. Large number of parenchymatous cells, vessels and other impurtities were seen in 200 and -200 fractions.

Refer photomicrographs 1A, 1B, 1C, 1D and 1E of fibers which were taken from 28, 48, 100, 200 and -200 mesh respectively. Photomicrograph 1F indicate the cross section view of internode where vascular bundles are located underneath of epidermal layer. Outside the rind layer of kans stalk at the surface is found a thin, but very dense epidermis. It contains waxes and other material and is very resistant to pulping.

This epidermis layer is usually much darker than the pith components. Its cells dissolve very slowly and incomplete during the pulpng process, if not removed during depithing.

RAW MATERIAL PREPARATION

kans contain adhering soil, sand and other impurities. It is essential that these undesirable components be removed prior to pulping. Chopping, screening, cleaning and depithing are important step used in fiber preparation to upgrade the materials because approximately 33% of oven dry weight of kans stem consists of pith or parenchymatous cells and about 4% of dense epidermis materials. The stem of kans were chopped to 20-40 mm length and were screened to remove over size chips by vibrator. Depithing experiments of kans were carried out from accepted chips.

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1A. Photomicrographs of fibre in 28 mesh of fibre classifier.

1B. Photomicrographs of fibre in 48 mesh of fibre classifier.

1C. Photomicrographs of fibre in 100 mesh of fibre classifier.

1D. Photomicrographs of fibre in 200 mesh of fibre classifier.

1E. Photomicrographs of fibre in -200 mesh of fibre classifier.

WET DEPITHING OF KANS

Pith is characterized by its dust form and it is undesirable from the pulping point of view due to their shorter length, greater surface and void volume that absorbs pulping chemicals.

Pith tends to swell and becomes gelatinous causing difficulties by closing of the wire of paper machine, sticking to the press machine with frequent paper breaks. Pith therefore must be removed as much as possible before pulping.

In laboratory experiment removal of pith was done by wet depithing in disc refiner having 2.5 mm gap between two bar. After depithing pith was separated out from chips by Johnsons screen. Depithed chips were taken for pulping experiments. The effect of depithing on soda A.Q. pulping in a laboratory scale were studied.

Photomicrograph of pith (Parenchymatous tissue), undepithed and depithed kans fiber are shown as **figure 2A, 2B and 2C** respectively.

SODA ANTHRAQUINONE PULPING OF DEPITHED AND UNDEPITHED KANS GRASS

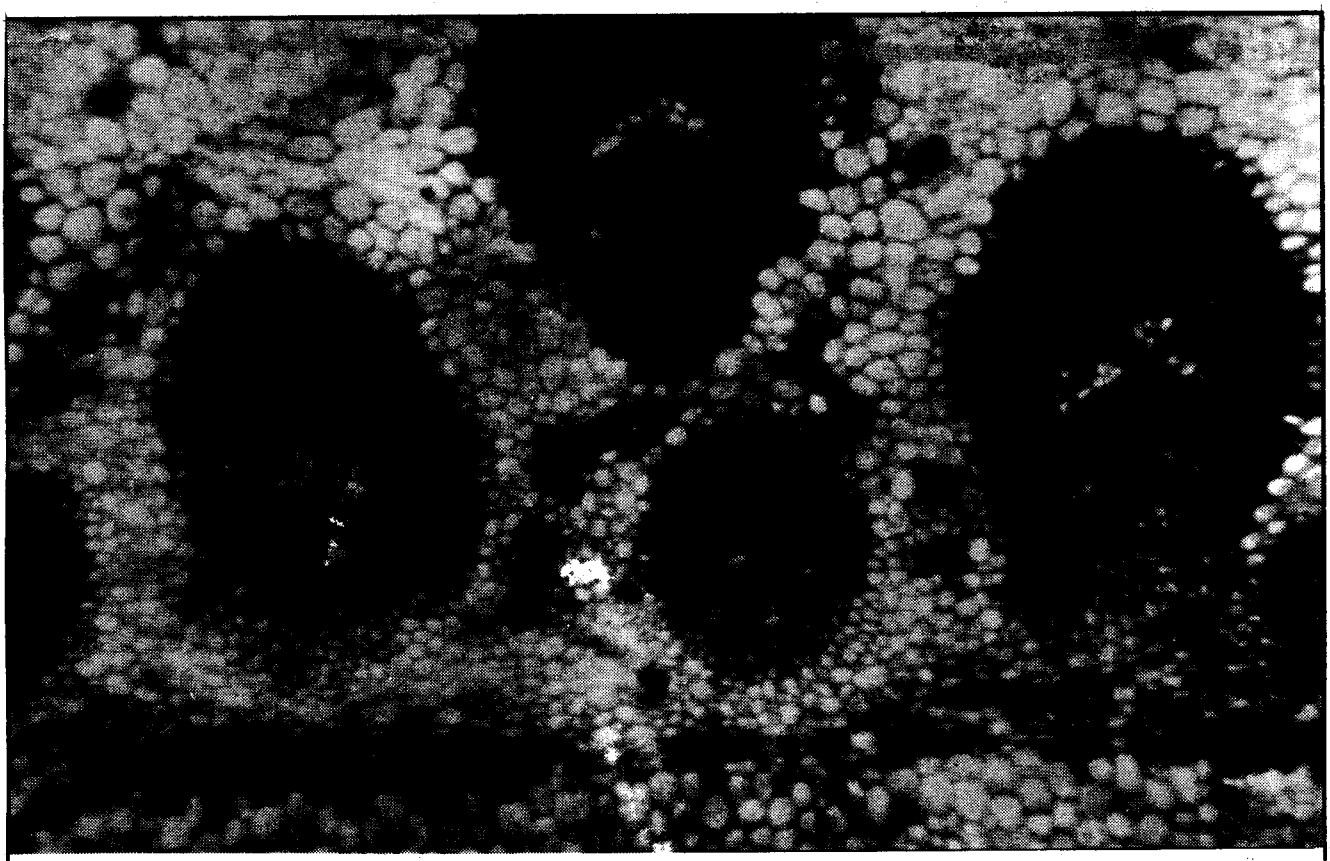
1. EXPERIMENTAL

1st set of cooking in Autoclaves was designed to get information about effect of depithing on soda consumption, pulp properties and strength properties of hand sheet paper.

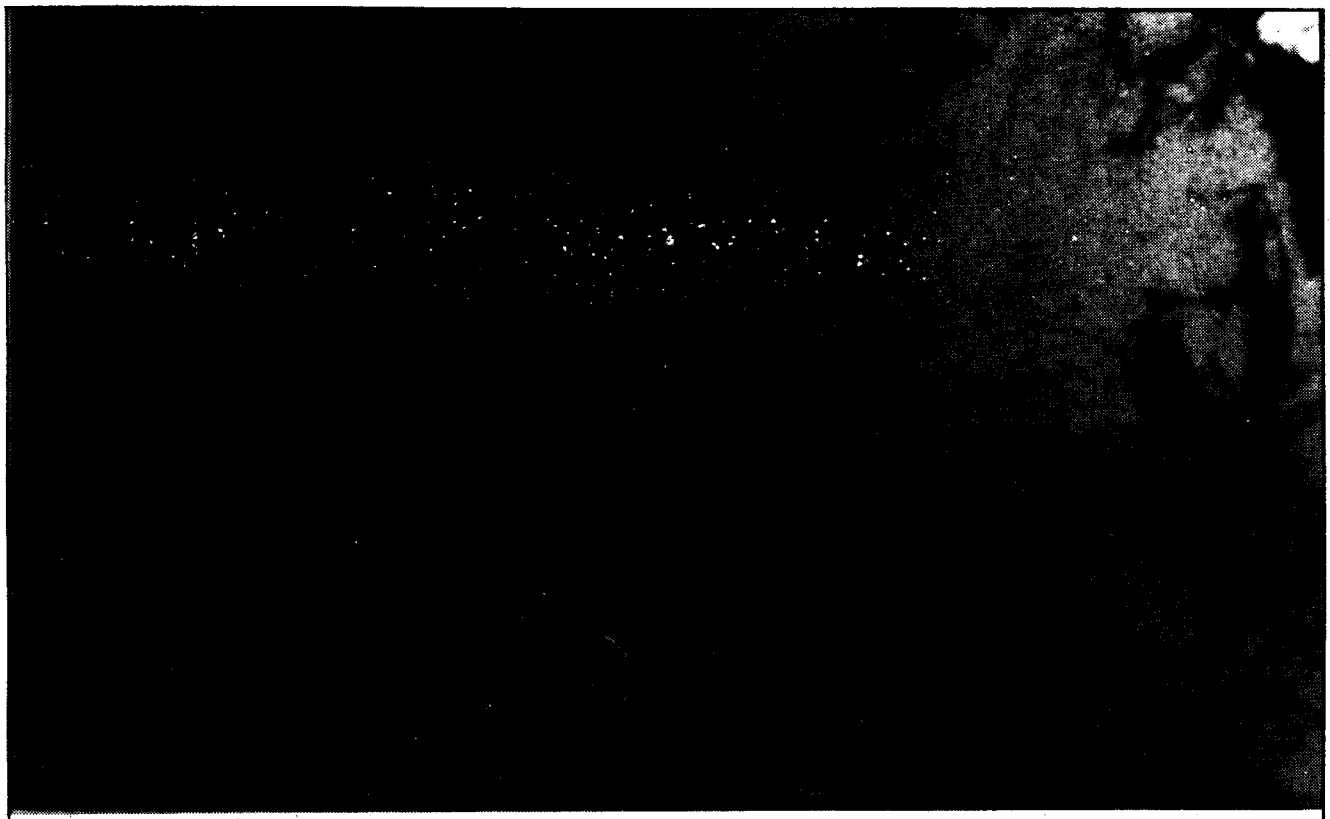
RESULTS AND DISCUSSION

As can be seen from Table No.1 pulping of depithed kans with 13% caustic soda and 0.1% anthraquinone has resulted higher screened yield, lower kappa no. and higher unbleached pulp brightness compared to the pulp produced from undepithed kans under same cooking conditions and chemical charge.

Refer **Table No.1** and **figure 3A** for comparison the soda A.Q. pulping results of depithed and undepithed kans grass. **Table No.2** gives results of strength properties.

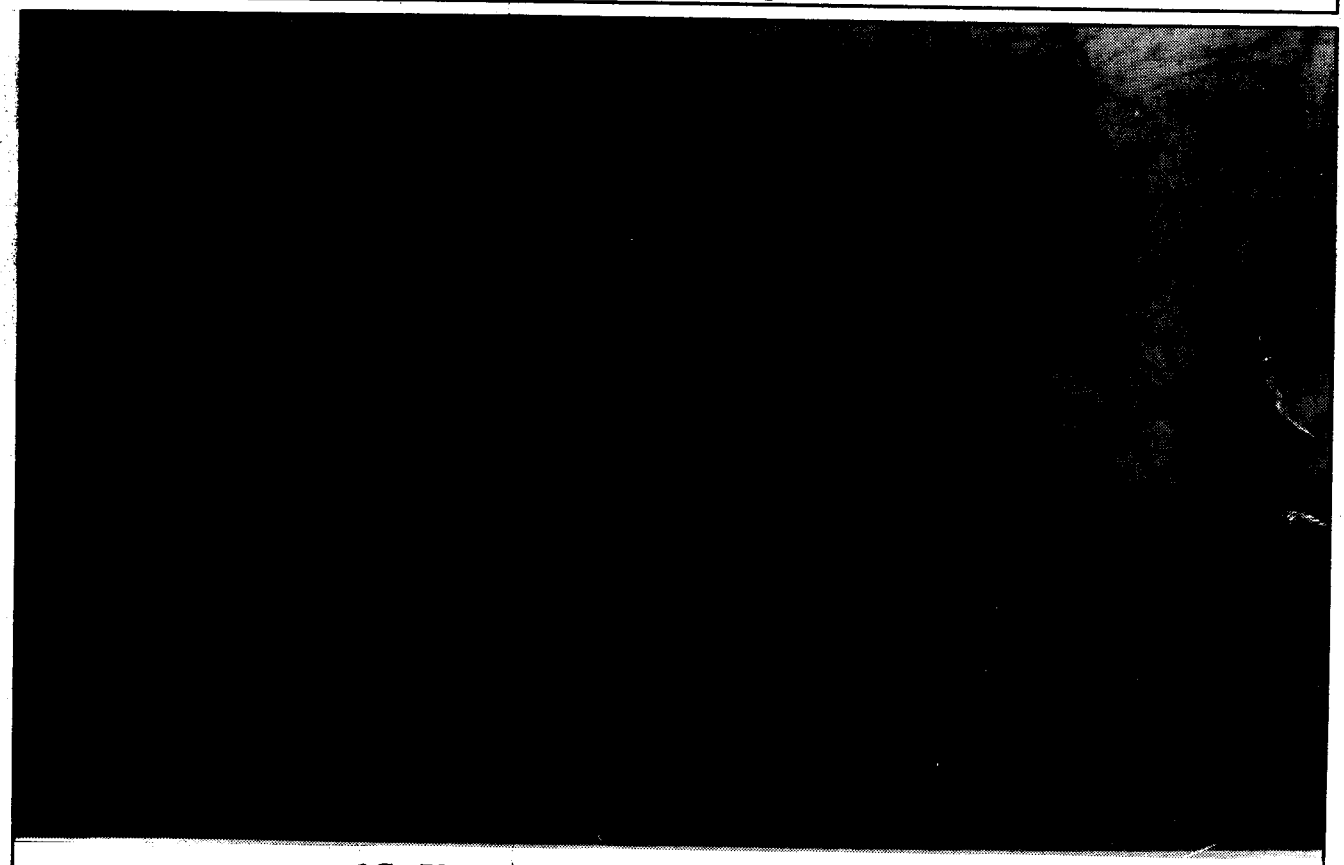


1F. Cross section view of internode of kans stem.



2A. Photomicrographs of pith cells.

2B. Photomicrographs of undepithed kans fibre.



2C. Photomicrographs of depithed kans fibre

Table-1			
Comparison of the Cooking Results of Undepithed and Depithed Kans Soda A.Q. Pulp			
Conditions		**Undepithed**	**Depithed**
O.D. of chips	g	227.96	227.96
NaOH	%	13.0	13.0
Anthraquinone	%	0.1	0.1
Bath ratio		1:5	1:5
Temperature	^{0}C	160.0	160.0
Temp. Rising time	Min	45.0	45.0
T. cooking time hr:	Min	4:10	4:10
pH of black liquor		10.6/10.8	11.4/11.7
Pulp yield	%	653.0	60.1
Pulp yield screened	%	51.7	58.3
Kappa no.		16.7	11.3
ISO Brightness unbleached pulp	%	25.7	32.3

LABORATORHY BLEACHING OF SODA A.Q. UNBLEACHED PULP WITH AN OXYGEN EXTRACTION STAGE.

3. EXPERIMENTAL

Soda A.Q. pulp (kappa no. 16.7) were used for bleaching studies. Experiments were done to obtain 70% ISO brightness by EOH and EOCH sequences.

Table-3		
Oxygen Extraction And Bleaching of Soda A.Q. Unbleached Pulp		
Pulp quantity	g.	86.0
Pulp consistency	%	10.0
Sodium hydroxide	%	2.0
Magnesium sulphate	%	0.3
Oxygen pressure kg/cm^2		6.0
Reaction temperature ^{0}C		100
Reaction time hr		1.0
pH after oxygen Delignification		11.8
Initial kappa no.		16.7
Final kappa no.		7.94
Initial viscosity cm^3/g		1050
Final viscosity mc^2/g		872
ISO brightness %		39.2

Table-2		
Comparison of the Strength Properties of Hand Sheet Prepared From Depithed and Undepithed Unbleached Pulp		
Properties	**Depithed**	**Undepithed**
OSR	44	47
Basis weight g/m^2	63.7	60.3
Tensile index KNm/kg	62.6	61.7
Tensile energy absorption J/M^2	957.8	768.3
Breaking length Km	6.4	6.3
Elongation %	2.4	1.9
Tensile stiffness MNm/Kg	7.0	7.9
Apparent density kg/m^3	670.4	622.7
Tearing resistance mN	362.5	341.0
Tear. index Nm^2/kg	5.7	5.6

Table-4		
Bleaching		
Sodium hypochlorite	%	4.0
Consistancy	%	5.0
Temperature	^{0}C	40.0
Reaction time	hr	2.0
End	pH	12.0
ISO brightness	%	67.8
Viscosity	cm^3/g	774.5

Refer Table No.3 for conditions and results of oxygen bleaching. SCAN test methods were used for kappa no. and viscosity determination.

Table-5		
Bleaching Conditions And Results		
Stage:	**Chlorination**	**Hypochlorite**
Consistency %	3.0	5.0
Active chlorine % on O.D. pulp	0.64	2.0
Reaction temp. ^{0}C	20	40
End pH	2.0	11.5
Reaction time hr	1.0	2.0
ISO brightness %	----	70.5
Viscosity cm^3/g	----	770.0

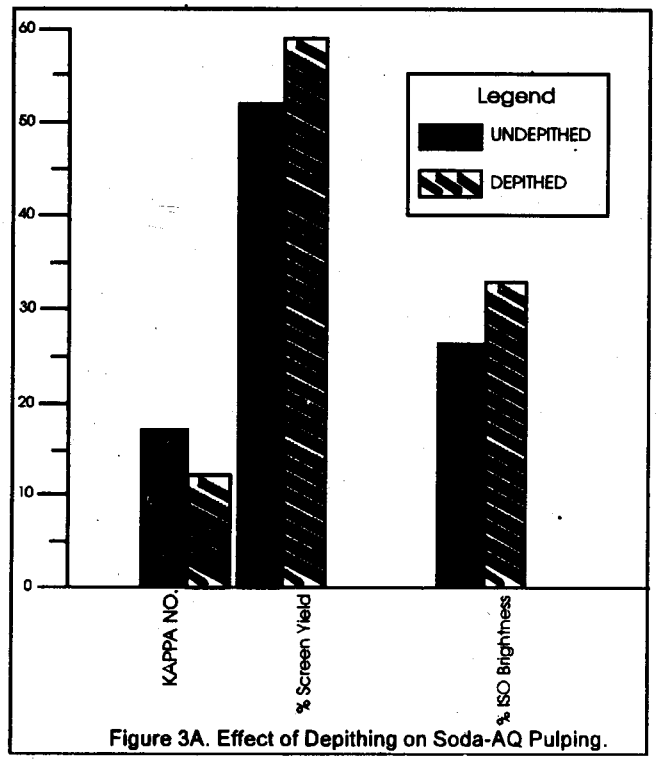


Figure 3A. Effect of Depithing on Soda-AQ Pulping.

4. RESULTS AND DISCUSSION

Kappa no. of cooked pulp dropped by about 52% (from 16.7 to 7.94). Brightness of 68% ISO could be developed with a consumption of only 4.0% active chlorine in EOH sequence, refer **Table No.4.** for results and brightness of 70.5% ISO could be developed with a consumption of 2.64% active chlorine in EOCH sequence, refer **Table No.5** for condition and results.

CONCLUSION

A series of undepithed and depithed kans soda A.Q. pulping were completed. The aim was to compare the pulping results and physical properties of paper between depithed and undepithed kans.

The major findings are as follows:

A) Under similar pulping conditions depithed kans give higher yield, lower kappa no. and higher unbleached pulp brightness than that of undepithed kans.

B) Kappa no. of cooked pulp dropped by about 52% (from 16.7 to 7.9) by oxygen delignification .68% ISO brightness can be developed with a consumption of only 4% active chlorine in EOH sequences.

C) The physical strength e.g. tensile index, breaking length, tear index are some what higher than that of undepithed kans.

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