Pulping of Acrocarpus Wood

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ABSTRACT

Acrocarpus is a fast breeding species of hardwood grown in Andhra Pradesh. A detailed study was carried out to find out its suitability for paper making. The results of the study are presented in this paper. Acrocarpus wood can be used as a fibrous Raw material as a replacement for some of the hardwoods.

The growing demand for pulp and paper leads to the shortage of conventional fibrous raw material. Efforts are being made by the industry and the research organizations to explore the possibilities of utilizing newer and lesser known hardwood species and agricultural residues. In continuation of our studies on different hardwood species, available in the Andhra Pradesh, a detailed study was undertaken on Acrocarpus wood, a fast breeding species.

EXPERIMENTAL :

Preparation of raw material : The wood logs obtained from our forest department were debarked manually and chipped in plant chipper. The bark was cut manually to small pieces of 2 to 3 inches to be used for cooking along with chips.

The proximate analysis of debarked chips was done as per standard TAPPI procedures.

Kraft cooking of debarked chips was done with an active alkali of 15%. To find out the effect of bark, bark was added to the chips, in the proportion it was present in wood, and kraft cooks were done with an active alkali of 14.0% and 15.0%. Pulp Yield, permanganate number, unbleached viscosity were determined for all the pulps. All the pulps were evaluated for their strength properties at 40 SR. Blending with bamboo as well as mixed hardwood pulps in different proportions was done and strength properties were evaluated. The unbleached pulp of wood with bark was bleached using CEH sequence. The results of the study are presented in Tables—1-5.

TABLE—1
ACROCARPUS WOOD CHARACTERISTICS

1.	Bark content of wood (on ovendry basis)	11.75%
2.	Bulk density of chips	96Kgs/Cu.M.
3.	Proximate Analysis :	
	a) Ash	% 0.64
	b) 1% NaOH Solubility	%21.88
	c) Alcohol benzene solubility	% 4 64
	d) Holo Cellulose (Ash corrected)	%77.57
	e) Lignin (Ash corrected)	%20.20
	f) Pentosans	%18.75
4.	Fiber dimension :	
	a) Average fiber length	: 1.05mm
	b) Average fiber diameter	: 0.022mm
	c) Runkel ratio	: 0.572

RESULTS AND DISCUSSION :

The bulk density of chips (96kg/Cu.m.) is very less than bamboo and normal hard woods. From the proximate analysis (Table 1) it can be seen that the alcohol-benzene extractives content of acracarpus is comparable to that of normal hardwoods. Lower lignin content suggested less cooking chemical demand.

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TABLE—2

PULPING CONDITIONS AND RESULTS OF ACROCARPUS WOOD

Sl. No.	Particulars		Debarked Wood	Wood with Bark	Wood with Bark
1.	Chemical as Na_2O,	%	15.0	14 0	15 0
2	Sulfidity of Cooking Liquor	%	16.78	16 78	16.78
3.	Bath ratio		1 : 2.8	1 : 2.8	1 : 2.8
4.	Cooking temperature,	°C	165	165	165
5.	Cooking Cycle,	Hrs	$1\frac{1}{2}+1$	$1\frac{1}{2}+1$	$1\frac{1}{2}+1$
6.	R.A.A. as Na_2O,	g/l	10.85	10.08	10.20
7.	Screened Yield,	%	47.2	48.3	46.7
8.	Rejects,	%	3.8	4.0	3.9
9.	Total Yield,	%	51 0	52.3	50.6
10.	Permanganate number		17.6	21.2	19.3
11.	Unbleached Pulp Viscosity,	cps	32.5	30.8	26.7
12.	**Pulp evaluation at 40° SR :**				
a.	Bulk	cc/gm	1.21	1.36	1.29
b.	Burst Index,	k Pa m^2/g	4.68	4 57	4.67
c.	Tear Index,	m $N.m^2/g$	4.91	5 30	5.30
d.	Breaking length,	km	8.72	8.26	8.73
e.	Double Folds, (Schopper)	No	346	277	335

TABLE—3

BLEACHING CONDITIONS AND RESULTS

1.	Permanganate number		..	21.2
2.	Chlorination Stage :			
	a) Consistency,	%	..	3.0
	b) Chlorine added as Cl_2,	%	..	5.0
	c) Retention time,	Hrs.	..	1.0
3.	Alkali Extraction Stage :			
	a) Consistency,	%	..	8.0
	b) Alkali added as NaOH,	%	..	2 0
	c) Retention time,	Hrs.	..	1.5
4.	Calcium Hypo Chlorite Stage :			
	a) Consistency	%	..	10.0
	b Hypochlorite added,	%	..	2.0
	c) Retention time,	Hrs.	..	3.0
5.	Bleached Pulp Yield,	%	..	42.5
6.	Brightness,	% Elrepho	..	82.0
7.	Viscosity,	cps	..	9.9
8.	Strength Properties at 40° SR :			
	a) Bulk,	cc/gm	..	1.09
	b) Burst index,	K Pa m^2/g	..	4 68
	c) Tear Index,	m N. m^2/g	..	5.20
	d) Breaking length,	km	..	8.37
	e) Double Folds,	No.	..	3.25

TABLE—4

UNBLEACHED STRENGTH PROPERTIES VS FREENESS

Sl. No.	°SR	Burst Index kPa.m²/g	Tear Index mN.m²/g	Breaking Length, km	Folds, Nos.	Bulk cc/gm.
1.	30	3.83	5.69	7.53	241	1.50
2.	36	4.22	5.49	7.81	257	1.44
3.	40	4.57	5.30	8.26	277	1.36

TABLE– 5

STRENGTH PROPERTIES OF BAMBOO—ACROCARPUS BLEND VS BAMBOO—MIXED HARD WOODS (MHWS) BLEND PULPS

Sl. No.	Particulars	Bulk cc/gm	Burst Index, kPa m²/g	Tear Index mN.m²/g	Breaking Length, km	Double Folds, Nos.
1.	100% Bamboo	1.94	3.14	10.20	5.85	161
2.	100% MHWS	1.83	3.53	6.28	5.58	42
3.	100% Acrocarpus Wood	1.36	4.57	5.30	8.26	277
4.	75% Bamboo + 25% MHW Pulp	1.84	3.43	8.34	5.66	80
5.	75% Bamboo + 25% Acrocarpus Pulp	1.70	3.53	8.04	6.23	159
6.	60% Bamboo + 40% MHW Pulp	1.82	3.54	7.95	5.79	93
7.	60% Bamboo + 40% Acrocarpus Pulp	1.68	3.60	7.65	6.53	103

NOTE : Blending after beating individually to 40° SR.

The pulp yield is comparable to that of bamboo and better than that of hardwoods at the same level of permanganate number. This is to be traced to the fact that its holo cellulose content is high. With increase of cooking chemical from 14 to 15%, there is a decrease in yield and permanganate number and slight improvement in strength properties as expected. Inclusion of bark does not affect much except slight rise in permanganate number.

A perusal of results In Table—3 shows that the bleach chemical demand for acrocarpus wood with bark pulp is very low when compared to bamboo and normal hard wood pulps of same permanganate number. This may be due to the lower lignin content of the wood.

The strength properties of both unbleached and bleached pulps are higher than bamboo except tear factor. The lower tear factor is due to shorter fiber length (1.05mm) and lower runkel ratio (0.572), an important factor[1] responsible for tearing strength of the pulps.

Results of blending study (Table-5) show that the strength properties of acrocarpus wood and bamboo blend are higher than bamboo and bamboo mixed hardwood blends, except tearing strength. However, on blending with bamboo, the tearing strength of acrocarpus wood pulp improved as expected. The colour of bamboo-acrocarpus wood blends hand sheets are lighter in shade than bamboo-mixed hard wood blends hand sheets.

CONCLUSION :

1. Lower bulk density of wood results in lower pulp yield per digester. However, due to shorter cooking cycle (compared to normal hardwood cooking cycle) more number of cooks can be carried out in a digester and also the higher yield compensates to certain extent.

2. The acrocarpus wood consumes less cooking and bleaching chemicals and yields pulp of good strength except tearing strength which can be improved by blending with a long fibered pulp in proper proposition.

The acrocarpus wood would certainly be a promising raw material for Indian Paper Industry because of its many advantages.

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