

Jute Root Cutting as Raw Material for more Paper

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SUMMARY

Jute is an important cash crop grown to the tune of about 1.5 million tons every year. About 10-15% of the crop contains hard bark roots at the basal portion of the fibre known as jute root. Jute root cuttings are partly used for making low grade yarns and partly sold at much lower prices in jute mills. It is an excellent raw material for making paper particularly of special grade. In order to achieve this objective a comparative study of different methods of pulping have been studied here. It has been found that high yield Soda chemi-mechanical pulp could be obtained from jute root cuttings by treatment with 10% NaOH solution. The strength characteristics of the pulp have been found to be very satisfactory. Addition of Anthraquinone (0.05%) during cooking of jute root cutting with caustic soda solution, improves the breaking length, fold and tear factor. Kraft pulping of jute root cutting gave good yield of bleachable grade pulp of very satisfactory strength characteristics.

INTRODUCTION

Jute is a cash crop grown extensively in the Eastern region of India to the tune of about 1.5 million tons every year. A significant percentage about 10-15% of the jute crop contains hard bark roots at the basal portion of the fibre. This is caused by bad growing conditions and irregular retting and this presents a great processing problem to the jute mills. This hard portion of the jute fibre known as jute root is cut off in the mills as it causes difficulties if processed along with the rest of the fibre. As a result jute root cuttings are partly used for low grade yarns and partly sold away at much lower price. Thus jute root cuttings are available as an excellent raw material for making paper particularly of special grade mainly because of low lignin and high α -cellulose content and long fibre length as described in Table I.

In order to realise this objective, a comparative study of the effects of different processes of pulping was made by the following methods :

1. Soda chemi mechanical pulping
2. Hot Soda chemimechanical pulping

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3. Soda Anthraquinone chemimechanical pulping
4. Kraft pulping

EXPERIMENTS AND RESULTS

I SODA CHEMI MECHANICAL PULPING

Jute root cuttings were soaked with NaOH of varying strength 5-20% on weight of raw material at liquor ratio 1 : 10, for 72 hrs. at room temperature. The yield was determined and standard hand sheets were made at a freeness of 60°SR to study the strength characteristics. Details are given in Table II.

The pulp obtained by treatment with 10% NaOH by the above method was beaten to different degrees of freeness. To study the strength properties at different degrees of freeness standard hand sheets were made as given in Table III.

II HOT SODA CHEMI MECHANICAL PULPING

Jute root cuttings were boiled in an open digester with NaOH of varying strength 10-20% on weight of raw material at liquor ratio 1 : 10 for 4 hrs. Yield of the pulp was determined and strength characteristics were evaluated by preparing standard hand sheets at a freeness of 50° SR. Details are shown in Table II.

**TABLE—I CHEMICAL COMPOSITIONS OF JUTE FIBRE COMPARED
WITH OTHER NON WOOD FIBRES**

Raw Material	% α -Cellulose	% Hemicellulose	% Lignin	% Ash
Jute Fibre	61	23	11	1.6
Jute Stick	41	34	23	0.8
Bagasse	39	32	20	3.3
Rice Straw	26	30	22	14.4

**TABLE—II PULPING CONDITIONS AND STRENGTH CHARACTERISTICS OF CHEMI-
MECHANICAL JUTE ROOT CUTTING PULP.**

Methods of Pulping	Strength of NaOH %	Anthra-quinone %	Liquor Ratio	Time of Soaking/ Open cooking Hours	Tempera- ture °C	Yield %	Breaking Length (metres)	Burst Factor	Tear Factor	Fold No.
Soda Chemi	5	—	1:5	72	Room temp.	86.5	6120	38	150	264
Mechanical Pulping	10	—	1:5	72	Room temp.	80.2	7396	40	152	1079
	15	—	1:5	72	Room temp.	80	6365	33	171	581
	20	—	1:5	72	Room temp.	80	5420	31	178	375
Hot Soda Chemi	10	—	1:10	4	95°	74	6345	—	124	716
Mechanical Pulping	15	—	1:10	4	95°	76	7623	—	112	524
	20	—	1:10	4	95°	73	6330	—	130	656
Soda Anthra-quinone Chemi	10	0.05	1:10	3	95°	75	7548	—	193	466
Mechanical pulping	13	0.05	1:10	3	95°	74	9303	—	166	949
	20	0.05	1:10	3	95°	73	8804	—	139	614

**TABLE—III STRENGTH PROPERTIES OF SODA CHEMIMECHANICAL JUTE ROOT CUTTING
PULP BEATEN TO DIFFERENT DEGREES OF FREENESS**

Nature of Pulp	°SR	Strength of NaOH %	Liquor Ratio	Time of soaking hours	Temp.	Yield	B.L (m)	T.P.	Fold No.
Soda Chemimechanical jute root cutting pulp. (obtained by treatment with 10% NaOH)	47	10	1:5	72	Room Temp.	80.2	4426	195	211
	55	10	1:5	72	Room Temp.	80.2	5926	160	649
	60	10	1:5	72	Room Temp.	80.2	7396	152	1079
	65	10	1:5	72	Room Temp.	80.2	6582	130	672

III SODA ANTHRAQUINONE CHEMIME- CHEMICAL PULPING

Jute root cuttings were boiled in an open digester with NaOH of different strengths 10-20% on weight of raw material along with 0.05% Anthraquinone at liquor ratio 1:10 for 3 hrs. Yield of the pulp was determined and standard hand sheets were prepared at a freeness of 50° SR to evaluate the strength characteristics. Results are shown in Table II.

IV KRAFT PULPING

Jute root cuttings were cooked in a rotary digester for 3 hrs. at 160° at 11.6% chemical and different sulfidities (3.9-7.9)%. The yield and permanganate number of the pulp were determined and finally standard hand sheets were made at a freeness of 50°SR to study the strength characteristics. Results are given in Table IV.

Table III further shows that among the three NaOH concentrations tried treatment with 15% NaOH along with 0.05% anthraquinone gives soda anthraquinone chemimechanical pulp of highest breaking length, fold number, high tear factor as well as high yield. It is also evident that soda anthraquinone chemimechanical pulp gives higher strength results at all the three NaOH concentrations tried, when compared with the other two chemimechanical pulping results.

Table IV shows that bleachable grade Kraft pulp of highest breaking length, high fold number and tear factor along with good yield were obtained at 11.6% chemical as Na₂O and 3.9% sulfidity as Na₂O.

The above investigations indicate that soda anthraquinone chemimechanical pulp of jute root cuttings can be used for making low cost high

TABLE—IV PULPING CONDITIONS AND STRENGTH CHARACTERISTICS OF
JUTE ROOT CUTTINGS KRAFT PULP

Method of Pulping	Percent chemical as Na ₂ O %	Sulphidity as Na ₂ O %	Liquor Ratio	Temp. of cooking °C	Time of cooking hours	Yield %	B.L. (metres)	T.F.	Perm. No.	Fold No.
Kraft pulping	11.6	3.9	1:5	160	3	62.2	8634	165	12	1350
	11.6	5.9	1:5	160	3	67	7456	180	12.5	1537
	11.6	7.9	1:5	160	3	60	6253	185	7.9	1489

DISCUSSIONS AND CONCLUSIONS

Table II reveals that among the four NaOH concentration tried treatment with 10% NaOH gives a Soda chemimechanical pulp which has the highest breaking length, fold number, burst factor and high tear factor along with high yield. Table III shows that this pulp gives the highest strength properties at a freeness of 60°SR.

Table II also shows that among the three NaOH concentrations tried treatment with 15% NaOH gives hot soda chemimechanical pulp of highest breaking length, high tear factor and fold number along with highest yield.

grade paper, whereas Kraft pulp can be used for making bleachable high grade paper.

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