Utilization of agricultural residues using mechano-chemical pulping process

NARAYAN OM,* JOSHI N. C.,* BHANDARI K. S.** and SHARMA Y. K.**

SUMMARY

Based on extensive investigations on utilisation of agricultural residues by Mechano-Chemical Pulping Process, a mill has been set up in Uttar Pradesh. The paper discussed the mechanochemical pulping of agricultural residues blended with Sabai grass. Soda-lime cook was found to have doubtful econnomic suitability while caustic cooks resulted in shorter cooking cycle and substantially better strength properties with little or no change in yield. Some of the research findings by substituting caustic soda partly by soda ash/sodium sulphide, the application in the mill and continuing search for alternate raw materials are discussed.

Special features of the process and properties of paper made on industrial scale are also recorded.

The project was conceived to produce paper specifically tailored for corrugating medium. In India, Kraft paper, manufactured from a blend of softwood, bamboo and hardwood fibre is generally used for fluting. It was felt that a product with high Concora (CMT) values made from agricultural residues would be a better and cheaper product for use in fluting and would help to conserve scarce wood/bamboo raw materials. Of the high yielding pulping processes Mechano-chemical pulping was selected in preference to the continuous straw digester to reduce capital investment. Laboratory and pilot plant trials conducted at Institute of Paper Technology, Saharanpur and Cellulose and Paper Branch, Forest Research Institute & Colleges, Dehra Dun respectively, established the suitability of the process and the parameters prior to commercialization. A brief out line of the process and the experience of mill is discussed.

Pilot Plant Trials at Cellulose and Paper Branch, Forest Research Institute and Colleges, Dehra Dun.

Mechano-chemical process was used for pulping of rice straw, wheat straw and bagasse. The hydrapulper used was having a comparatively bigger window (30 cm × 30 cm) in the screen plate so as to help in discharging the treated material at consistency of 6 7% Conditions of pulping was as follows—

Production of Rice straw pulp

Rice straw was cut to about 2-3 cm. length in chaff cutter and screened over a flat screen. The screened straw had a moisture content of 30%. The cut straw was loaded in a hydrapulper containing 8% lime (as CaO) and 1% Caustic soda (as NaOH). The consistency in the hydrapulper was adjusted to 10% and the temperature was maintained at 98°C. At the temperature treatment was continued for 45 minutes. The rotor of the hydrapulper was kept running throughout the period of treatment. The straw after treatment was pumped from hydrapulper to a banning beater for defibration. The straw pulp was then run over a sand table and kamyr washer. The unbleached pulp yield was 58.8% and the rejects were 0.9% on oven-dry straw. Wet laps were taken out on the paper machine after passing the pulp through Jones No. 1 conical refiner. The freeness of the pulp was 235 ml. (C.S.F.)

Production of wheat straw pulp

6% lime (as Cao) and 1.5% caustic soda (as NaOH) were used as cooking chemicals at 10%

* Uttar Pradesh Straw & Agro Products Ltd., Aghwannur, Moradabad (U.P.)

** Cellulose and Paper Branch, Forest Research Institute Dehra Dun (U.P.)

consistency and 98°C temperature. The consistency in hydrapulper was adjusted to 10% and the temperature was maintained at 98°C. At this temperature, treatment was continued for one hour. The treated wheat straw was pumped without any dilution from the hydrapulper to a Banning beater for defibration. The consistency in beater was 6.0%. After fiberization the pulp was transferred to a chest and washed on kamyr filter. The washed pulp was screened. The pulp yield was 55.5% on o.d. straw and rejects 9.3%. The screened pulp was further fiberized through Jordan refiner at a consistency of 3.0%. After refining wet laps were made. The 9.3% rejects consisted of treated straw which could not be defiberized in beater.

Production of Bagasse Pulp

Whole bagasse was dry depithed by a single pass through a hammer mill and screened on 16 mesh.

7.0% lime (as CaO) and 3.0% caustic soda (as NaOH) were used as cooking chemicals. At about 98°C temperature the treatment was continued for 105 minutes. After the treatment the treated bagasse was pumped without dilution from the hydrapulper to a Banning beater for defibration. The consistency in the beater was 7.5%. After defiration the pulp was transferred to a chest and the pulp was washed. The pulp yield was 71.4%.

Production of Paper

Three trials, first from 95% rice straw pulp blended with 5% kraft waste paper, second from 100% wheat straw and third from 75% wheat straw pulp blended with 25% bagasse pulp were taken. The pulp ran smoothly on the paper machine in all the three trials. The conditions of stock preparation, papermaking and physical strength properties of paper produced are recorded in Table-I.

TABLE—1 PAPERMAKING CONDITIONS AND STRENGTH PROPERTIES

Sl. No.	Particular	Ist trial (95% Rice straw Pulp & 5% kraft waste paper pulp)	IInd trial (100% wheat straw pulp)	IIIrd trial (75% wheat straw pulp & 25% Bagasse pulp)
1.	Consistency of pulp in beater, %	8.35	6.0	6.7
2.	Freeness of pulp before beating, ml. (CSF)	210	270	230
3.	Freeness of pulp after bearing, ml. (CSF)	Not beaten	160	175
4.	Rosin soap on O.D. pulp, %	—	1	1
5.	Alum on O.D. pulp, %	—	5	5
6.	Sodium Silicate on O. D. pulp, %	—	0.5	0.5
7.	Freeness after the addition of chemicals, ml. (CSF)	195	155	160
8.	Freeness after refining, ml. (CSF)	—	140	150
9.	Machine speed, m. p. m.	45	30	30
10.	Basis weight, g. s. m.	100	108	114
11.	Thickness, mm.	.203	.178	.178
12.	Breaking length, Km.			
	a) Machine direction	3.6	4.3	3.9
	b) Cross direction	2.1	2.9	2.2
13.	Burst factor	15.0	16.6	15.8
14.	Tear factor			
	a) Machine direction,	61.0	42.6	50.0
	b) Cross direction	69.0	52.8	57.0

Mechano Chemical pulping on industrial scale

Three 25 m³ pulpers with hot stock-refining in a disc refiner, screening, riffling and two stage washing were incorporated in the pulp mill. Instead of wet cleaning dry cyclone dedusting of straw was installed. This system of dedusting has only limited usefulness and effected about 2% silica removal as can be observed in Table II. High moisture content of straw reduced dusting efficiency and by regulating the moisture to a maximum of 15% its effectiveness improved considerably.

Proper cutting of the raw material had a marked effect on the uniformity of the cook. Wheat straw was obtained from threshers and required no further cutting, rice straw had to be cut. Cut size ranged from 15 to 30 mm. with 80% being above 20 mm. The need for blending some long fiber to improve the tensile strength and tearing resistance, of the Paperled to the use of sabai grass, the only long fibered raw material available locally which could be adapted to mechano-chemical pulping. This was b ended with the straw pulp. The approximate chemical analysis of the raw materials used by the mills is given in Table III.

Sabai is a difficult raw material to cut and is generally cooked as such in pressure digesters in this country. We found that cutting of sabai grass into acceptable sizes is greatly influenced by the condition of the knife edge. Proper knife changing frequency was established and knives were changed after every 4 tonnes of sabai cut. Damaged knife edge were hard faced, when required, prior to wet regrinding, which considerably increased knife life.

(B) Chemical Preparation

Cooking liquor comprising 6% lime as CaO and 2-3% caustic soda as NaOH was envisaged. Lime was slaked in a lime slaker followed by a double deck vibrating screen for grit removal. Subsequently nylon centricleaner bottles were installed in the milk of lime to remove finer grit. This had a marked improvement in the runability of the paper on the machine and improved the life of refiner tackle. 3% lime as CaO was lost along with grit from the centricleaners. On occasions during period of non-availability of caustic soda, only lime upto 9% as CaO on O.D. straw was used for

TABLE—2 SILICA REMOVAL IN DRY DUSTING

Ash, %	Rice straw		Wheat straw		Sabai grass	
	Undusted	Dusted	Undusted	Dusted	Undusted	Dusted
A_1	22.7	18.2	13.5	11.9	8.1	7.6
A_2	19.8	16.2	11.9	9.9	6 5	5.7

TABLE—3 PROXIMATE CHEMICAL ANALYSIS AND FIBRE DIMENSIONS

Sl. No.	Particulars	Sabai grass	Wheat straw	Rice straw	Bagasse	Kenaf
1.	Ash, %	6.0	8 5	15.1	1.8	2.4
2.	Hot water solubility, %	9.5	7.9	9.9	3.7	7.9
3.	1% NaOH solubility, %	39.7	—	44.7	27.8	26.8
4.	Alcohol-benzene solubility, %	4.1	3.2	5.1	1.9	1.86
5.	Klason lignin, %	22.0	20.3	16.6	22.5	21.5
6.	Pentosans, %	23.9	28.9	27.7	26.9	—
7.	Holo cellulose, %	66.4	67.0	62.7	70.40	72
8.	Average fibre length in mm.	2.08	1.10	1.13	1.40	1.80
9.	Average fibre diamater in um	09	12	16	18	32

cooking after installation of centricleners, without effecting paper quality and machine run.

(C) **Cooking**

The mechano-chemical pulper had an oversize rotor. No extraction plates are provided.

The total cooking cycle time from loading to discharge at the project stage was taken as 3 hours :

Loading	:	1 hour
Time to reach 98°C	:	½ hour
Cooking at 98°C	:	1 hour
Discharge	:	½ hour

In actual commercialization 4½ to 5 hours cycle time was obtained. An attempt to reduce cooking time resulted in extremely hard cooked pulp causing frequent jamming of pumps, the twin flow disc refiner and washers besides giving a shivy appearance to the paper. Attempts to reduce cycle time by increasing alkali content produced poorly washed pulp, foaming, poor machine run besides such intangibles as frequent break-down and jaming up of the wire and felts. The cooking conditions and strength properties of the paper made from typical lime cook having a blend of 65% straw and 35% sabai are indicated in Tables IV and Table V, respectively. Paper strength characteristics were low, burst factor ranging from 15.0 to 16.0 and breaking length 2.5-3.0 Km (MD) 1.6-2.0 Km (CD). CMT values were good. Another disadvantage of using a mixture of lime and caustic as cooking chemicals was the poor sizing reflected in high Cobb values despite abnormally high alum consumption as given in Table V. The presence of calcium ions in the stock has deterimental effect on sizing. A third stage washer was added to reduce calcium ions and though alum consumption reduced to 10% from 15% but it was still on the higher side.

TABLE—4 COOKING CONDITIONS OF CAUSTIC AND LIME COOK OF RICE STRAW, WHEAT STRAW AND SABAI GRASS

Cook No.	Rice straw			Wheat straw			Sabai grass		
	10	11	12	13	14	15	16	17	18
Caustic as NaOH, OD straw, %	2.0	1.5	1.0	3.5	2.5	1.5	2.5	2.0	3.0
Lime as CaO, OD straw,%	4.0	5.0	6.0	6.0	6.0	6.0	6.0	6.5	8.0
Loading, min.	60	60	60	60	60	60	60	60	60
Impregnation, min.	60	60	60	45	45	45	45	45	45
Cooking at 98°C, min.	90	90	90	140	140	150	140	155	125
Discharge, min.	30	30	30	30	30	30	30	30	30
Yield, %	59.0	62.5	64.0	58.0	62.8	68.2	61.1	60.0	59.2
Kappa Number,	60.1	62.3	63.5	64.3	68.7	77.8	68.5	77.3	65.4

SABLE—5 STRENGTH PROPERTIES OF PAPER

	Furnish : Wheat straw 65% Sabai grass 35%						Rice straw 65% Sabai grass 35%					
	Wheat straw 13*	+ Sabai grass 16*	Wheat straw 14*	+ Sabai grass 17*	Wheat straw 15*	+ Sabai grass 18*	Rice straw 10*	+ Sabai grass 16*	Rice straw 11*	+ Sabai grass 17*	Rice straw 12*	+ Sabai grass 18*
Burst factor	16.5		16.0		15.0		16.0		15.4		15.0	
Tear factor :												
MD	51		56		58		49		52		56	
CD	58		63		66		62		68		72	
Breaking length, m :												
MD	3.30		3.10		2.40		3.10		2.50		2.20	
CD	2.00		1.90		1.40		1.85		1.70		1.60	
CMT, (pounds)	37.9		36.0		35.0		36.2		36.9		35.9	
Cobb	45		40		60		120		100		110	

*Refers to cook numbers of Table-IV

TABLE—6 EFFECT OF LIME ON ALUM CONSUMPTION AND COBB

Furnish : Wheat straw 65% Rice straw 35%
Sabai grass 35% Sabai grass 35%

(W—Wheat straw; R—Rice straw; S—Sabai grass)

	R	S	R	S	R	S	W	S	W	S	W	S	R	S	R	S	R	S	W	S	W	S	W	S
	19*	16*	11*	17*	12*	18*	13*	16*	14*	17*	15*	18*	1**	7**	2**	8**	3**	9**	4**	7**	5**	8**	6**	9*
Lime as Cao on OD. straw, %	4.0	6.0	5.0	6.5	6.0	8.0	6.0	6.0	6.0	6.5	8.0	8.0	.....	.....	.....	.....	.....	NIL	.....	.....	.....	.....	.....	.....
Caustic as NaOH on OD. straw, %	2.0	2.5	1.5	2.0	1.0	3.0	3.5	2.5	2.5	2.0	1.5	3.0	4.0	6.0	4.5	6.5	5.0	7.0	6.0	5.0	6.5	8.5	7.0	
Rosin, %	1.00		1.10		1.20		1.20		1.30		1.40		0.50		0.50		0.40		0.40		0.36		0.38	
Alum, %	8.0		12.0		16.0		10.0		15.0		18.0		5.3		5.0		4.8		4.8		4.7		4.6	
Cobb	120		100		110		60		40		60		37		33		32		32		31		32	

* Refer to Cook Numbers of Table—IV

** Refer to Cook Numbers of Table—VII

Caustic soda in the cooking liquor to the extent of 2-3% was not actively participating in the cooking but was working more as a source of desilification as there was little or no difference in paper properties even when only lime was used as the only cooking chemical.

Lime-caustic cook was replaced by a totally caustic soda cook for the following reasons :—

a) To reduce total cooking cycle time as this was a serious bottleneck in terms of productivity.
b) To reduce alum and rosin consumption.
c) To improve the strength characteristics of the paper.

The cooking conditions and the paper properties are listed in Table VII and VIII, respectively. The cooking cycle was considerably reduced which was closely approximating the design conditions. Yields of cooked pulp remained virtually unchanged while the strength properties showed marked improvement. Burst factor improved to 22.0 and breaking length to 4.8 km (MD) and 2.8 km (CD). Alum and rosin consumption came to well within acceptable limits (Table VI), rosin 0.5% and alum 4-5%. The line of refiner tackle, wires and felts improved and breakdowns reduced considerably. The nett result was an economic gain besides the paper is not being used both for fluting as well as for liner.

Search for Alternative Raw Material

Due to uncertain supply of rice straw and wheat straw used by the mills, search for alternative raw materials was considered to be essential to keep the raw material supply on sustained yield basis to the mill. Extensive investigations were carried out on bagasse *(Sachharum officisinarmu)* Sabai grass *(Eulaliopsis binata)*, Sarkanda *(Sachharum ravennae)* and Kenaf *(Hibiscus cannabinus)*, in the mill laboratory as well at Cellulose and Paper Branch, Forest Research Institute, Dehra Dun.

The treated raw materials are defibred in laboratory disc refiner at plate clearance of 10 mm. and

TABLE—VII. COOKING CONDITIONS OF RICE STRAW, WHEAT STRAW AND SABIA GRASS.

	Rice straw			Wheat straw			Sabai grass		
	1	2	3	4	5	6	7	8	9
Caustic as NaOH, %	4.0	4.5	5.0	6.0	6.5	7.0	6.0	6.5	7.0
Loading, Min.	60	60	60	60	60	60	60	60	60
Impregnation, Min.	35	35	35	45	45	45	45	45	45
Cooking, Min.	30	30	30	65	65	65	60	60	65
Discharge, Min.	30	30	30	30	30	30	30	30	30
Yield, %	65.4	63.0	62.3	62.1	60.2	60.6	64.1	59.4	63.0
Kappa Number	62.2	60.4	58.8	70.1	68.5	66.1	68.7	64.4	54.3

TABLE—VIII STRENGTH PROPERTIES OF PAPER

Furnish : Wheat straw 65% Rice straw 65%
Sabai grass 35% Sabai grass 35%

		Wheat+Sabai	Wheat+Sabai	Wheat+Sabai	Rice+Sabai	Rice+Sabai	Rice+Sabai
Cook No.		4* 7*	5* 8*	6* 9*	7* 7*	2* 8*	3* 9*
Burst factor		22.0	23.0	25.0	24.5	24.0	25.0
Tear factor :	MD	52	50	48	50	55	56
	CD	61	58	56	60	65	67
Breaking length, Km.	MD	4.4	4.6	4.8	4.2	4.4	4.6
	CD	2.7	2.6	2.8	2.7	2.8	2.9
CMT (pounds)		35.1	33.0	29.9	35.0	33.9	35.0
Cobb		37	33	32	36	38	38

* Refer to Cook No. of Table—VII.

washed. The washed pulp was beaten in valley beater according to Tappi Standard and sheets were made using recirculation system provided on British Standard Sheet-making machine. The sheets were pressed and air dried. The air dry sheets were conditioned at 65±2% R.H. and 27±1°C temperature and tested for strength properties. The pulping conditions and physical strength properties of bagasse, sabai, sarkanda and kenaf are given in Table IX, X, XI and XII, respectively.

Mill scale trial were undertaken by replacing Sabai grass with Sarkanda. This raw material gave some problems in handling and jamming of refiner plates, due to its stem. However, these were overcome by adjustment in the process. The properties of paper produced by mill using 20% Sarkanda and 80% whole bagasse are recorded in Table XIV.

Variables in the Process

Modification of bagasse pulping by partial replacement of Sodium hydroxide by Sodium carbonate

An attempt was made to replace part of the sodium hydroxide by sodium carbonate. The pulps were processed in the similar manner as reported earlier and tested for strength properties. The conditions of modified cooking process and strength properties of the hand sheets are given in Table XIII.

Based on the above experiment mill scale trials were undertaken. No difficulty in processing of pulp and papermaking was observed. The strength properties of paper made in the mill are recorded in Table XIV.

TABLE--IX. COOKING CONDITIONS AND STRENGTH PROPERTIES OF BAGASSE PULP

Sl. No.	Particulars	Cook No. 1B	2B	3B	4B
1.	Cooking chemicals, on O.D. basis %	8.0	8.0	10.0	11.0
2.	Steaming time, Min.	45	45	45	45
3.	Cooking time at Lax. Temp. (98°C), Min.	60	90	60	60
4.	Kappa Number	80.2	77.1	65.9	51.1
5.	Yield, %	75.1	72.2	66.0	65.0
6.	Final freeness, ml. (CSF)	250	250	250	250
7.	Burst factor	14.0	20 4	22.0	24.0
8.	Tear factor	67.0	78.1	76 2	85.0
9.	Breaking length, km.	2.80	3.50	3.66	3.85
10.	C.M.T. (Pounds)	35.8	—	30.4	—

TABLE—X. COOKING CONDITIONS AND STRENGTH PROPERTIES OF SABAI GRASS.

Sl. No.	Particulars	Cook No. 1	2	3	4	5	6	7	8
1.	Cooking chemicals, on O.D. basis. %	6.0	7.0	7.0	7.0	8.0	8.0	9.0	10.0
2.	Steaming time, min.	45	45	45	45	45	45	45	45
3.	Cooking time at 98°C min.	120	75	90	120	60	75	45	30
4.	Kappa Number	62.4	61.3	50.0	—	56.6	48 9	50.0	39.1
5.	Yield, %	67.7	59.4	64.0	59.2	60.4	55.4	53.0	52.0
6.	Final Freeness, ml. (CSF)	175	175	175	175	175	170	250	250
7.	Burst factor	17.6	22.6	26.6	27.6	33.0	30.0	32.0	30.0
8.	Tear factor	104.0	99.1	99.4	95.0	87.0	86.5	94.0	100.0
9.	Breaking length Km.	2.78	3.36	4.08	3.75	5.49	4.50	5.00	5.24
10.	C.M.T. (Pounds)	42.2	28.5	33.3	30.2	34.6	38.4	31.5	—

TABLE—XI. COOKING CONDITIONS AND STRENGTH PROPERTIES OF SARKANDA

Sl. No.	Particulars	Cook No. 1S	2S	3S	4S	5S
1.	Cooking chemicals, on O.D. basis	8	9	10	10	14
2.	Steaming time, Min.	45	45	45	45	45
3.	Cooking time at max. temp. (98°C), Min.	90	90	90	75	60
4.	Kappa Number	77.3	75 0	71.6	76 0	42.3
5.	Yield, %	75.0	66.8	61.5	63.2	58 3
6.	Burst Factor	23.7	25.2	27.4	26.4	40.0
7.	Tear Factor	46.0	44.5	40.0	50.0	80.0
8.	Breaking length Km.	4.00	4.29	4.50	4.88	5.51

TABLE—XII. COOKING CONDITIONS AND STRENGTH PROPERTIES OF KENAF

Sl. No.	Particulars	1	2
1.	Cooking chemical, on O.D. basis, %	10	12
2.	Steaming time Min.	30	30
3.	Cooking time at 98°C, Min.	90	90
4.	Kappa Number	124.1	110.0
5.	Yield, %	66.2	59.90
6.	Freeness ml. (C.S.F.)	250	250
7.	Burst Factor	29.2	30.6
8.	Tear Factor	57.1	63 3
9.	Breaking length, Km.	5.8	6.2
10.	Stretch, %	4 41	3.18

TABLE—XIII. LABORATORY SCALE PULPING OF BAGASSE WITH THE REPLACEMENT OF SODIUM HYDROXIDE BY SODIUM CARBONATE.

Sl. No.	Particulars	Cook No. 1	2	3
1.	Cooking Chemicals on O.D. basis, %			
	(a) NaOH	10.0	8.0	6.0
	(b) Na_2Co_3	—	2.0	4.0
2.	Steaming time, Min.	45	45	45
3.	Cooking time at Max. temp. (98°C), Min.	120	120	120
4.	Kappa Number	66 0	82.3	83.0
5.	Yield, %	58.5	65.0	66.0
6.	Freeness, ml. (CSF)	275	275	275
7.	Burst Factor	24.0	23.0	17.0
8	Tear Factor	58	63	64
9.	Breaking length, Km.	3.00	1.99	2.50

TABLE—XIV. STRENGTH PROPERTIES OF MILL SAMPLES COOKED WITH PARTIAL REPLACEMENT OF SODIUM HYDROXIDE BY SODIUM CARBONATE IN BAGASSE PULPING.

Sl. No.	Particulars		Cook No. 1	2	3	4	5	6
1.	Cooking chemicals,% on O.D. basis,	(a) NaOH	10.0	8.0	7.0	8.0	9.0	10.0
		(b) Na_2Co_3	—	—	2.0	2.0	2.0	—
2.	Burst Factor		19.1	18.1	16.3	20.7	22.6	19:1
3.	Tear Factor	M D	55.2	51.9	40.0	49.6	56.8	39.5
		C D	61.9	53 8	47.0	55.2	61.3	49.3
4.	Breaking length, Km.	M D	5.1	3.7	4.7	5.4	5.5	5.3
		C D	3.4	3.2	3.0	3.2	3.8	3.2

Furnish :—For No. 1, 2, 3, 4 and 5,20% Sabai and 80% bagasse and for No. 6 20% Sarkanda and 80% Bagasse were used. Cooking conditions and chemicals (9% NaOH) for Sabai grass was kept constant in all the cases. Cooking conditions for bagasse were kept constant and the cooking chemicals are mentioned in the Table.

TABLE—XV. COOKING CONDITION AND STRENGTH PROPERTIES OF MECHANO-CHEMICAL PULPS USING SODIUM HYDROXIDE AND SODIUM SULPHIDE.

Sl. No.	Particulars	Cook No. 1	2	3	4	5
1.	Cooking chemicals in % on O.D. basis	10	10	10	10	8.5
2.	Sulphidity, %	25	15	10	—	15
3.	Steaming time, min.	30	30	30	30	30
4.	Cooking time at max. temp. (98°C), min.	90	90	90	90	90
5.	Kappa Number	62.2	55.5	58.9	66.1	69.4
6.	Yield, %	65.3	65.6	63.3	65.2	64.1
7.	Final freeness C.S.F.	250	250	250	250	250
8.	Burst Factor	17.1	20.4	19.4	17.3	14.1
9.	Tear Factor	50.4	46.1	49.2	52.8	56.1
10.	Breaking length, Km.	4.30	4.90	4.38	4.45	3 89
11.	Strech, %	2.68	2.54	2.88	2.72	2.74

Cooking chemicals were added after 30 minutes of steaming.

Addition of Sodium sulphide in cooking liquor in Bagasse Pulping

Mechano-chemical pulping of Bagasse was carried out at different sulphidity ranging from 0 to 25% to observe the effect of hydrosulphide ion. The cooking conditions and strength properties are given in Table XV.

CONCLUSION

In the mechano-chemical pulping system followed by hot stock refining for straw, whole bagasse, sabai grass, Sarkanda and Kenaf pulped for high CHT papers of good yields are obtained. The system is, comparatively power intensive. Some blending of longfibred pulp is necessary with straw and bagasse for better strength properties and smooth runnability on the paper machine. Lime-soda cook has doubtful economic viability and results in poor paper strength characteristics. High CMT values impart good stiffness to corrugated board.

Laboratory and mill scale trials have shown that 2% sodium hydroxide could be replaced by 2% sodium carbonate in bagasse pulping at a total level of 10%, without adversally effecting the strength properties of paper. Laboratory scale pulping has established that 15% sulphidity would be optimum for bagasse pulping and shows an improvement in the burst factor.

Continuing research efforts at the mill laboratory and Cellulose and Paper Branch of the Forest Research Institute & Colleges, Dehra Dun have established successful running of the mill using mechano-chemical pulping process utilising locally available raw materials and shown considerable quality improvement in the end-product.