Alkaline pulping of sarkanda (Saccharum munja) with anthraquinone and steps taken to achieve higher yield

DARWESH H R.*, SHARMA MAHENDRA*

ABSTRACT

SARKANDA (Saccharum Munja) is a very useful non-wood fibrous raw material. Its Soda pulping has been carried with and without Anthra-quinone (AQ) on plant scale and results with 0.05% AQ are very encouraging. Brown stock washer's efficiency improvements was observed after introduction of refiners in the system. The bleaching of the pulp was carried and 44-45% yield with 72-74% brightness was achieved.

Alkaline Pulping of Sarkanda (Saccharum Munja) was carried out with AQ under varying conditions on plant scale. Effect of AQ addition was examined. It was found that the advantage of AQ addition in pulping were evident. Drastic change in the nature of pulp and yield was observed. Easily bleached pulp in about 44 to 45% yield and of 72 to 74% brightness could be prepared.

Grasses, particularly of Sarkanda and Wheat Straw are abundantly available in our country. In Punjab, Sarkanda is abundantly available. It is a very large erect grass growing in clumps growing up to 6 m. tall, growing well on alluvial sandy banks of streams. Clums biennial, pale, solid pithy, smooth, with an inconspicuous growth ring and root zone. These species include a large number of forms varying in habit, nature of inflorescence and adaptability to soil conditions. Some of them grow in very dry climate. Munjgrass contains (oven-dry basis) : cellulose 58.2%, lignin 20.5% pentosans 23.7%, and ash 2.3%.

Sarkanda is a promising raw material and could easily supplement the growing requirements of pulps provided their pulping is made more efficient and economical than at present.

Considerable work has been done on modification of the existing processes to achieve this goal. Apart from conservation of energy and resources the need to abate air and water pollution is another constraint as the development of new processes.

AQ as an additive pulping appears promising to meet many of such requirements. It gives a dramatic increase in yield, reduces chemical consumption thereby making the process more economical and help to avoid the use of Sulphur chemicals which emit obnoxious gases, are scarcely available in our country.

The present work describes the effect of addition of AQ in alkaline pulping of Sarkanda with cooking at 150°C temperature in spherical rotary digesters, and a comparison of the results with the conventional method of pulping, i e. soda pulping.

RESULTS AND DISCUSSION :

The analysis of Sarkanda shows that these materials are rich in Hemicelluloses. The alpha cellulose content in Sarkanda is only 35% while that in case of wheat straw is 32%. Sarkanda grows to its full height in barely 4 to 5 months and so have a less developed an open morphological structure. It should be possible to delignify them with mild treatments using lesser chemicals and heat energy as compared to wood and Bamboo.

*M/s. Mukerian Paper Mills Ltd.,
P.O. Mukerian (Punjab)

Table No. 1.

SODA PULPING COOKING CONDITIONS

Raw Material	Caustic Charged %	Bath Ratio	Cooking Conditions Cooking Time Hrs.	Cooking Temp. °C	Digester cook sample Analysis K No.	R.A.A	Chemical Consumption on Bleached Pulp Prodn. Chlorine% Consumption	Lime% Consumption
Sarkanda and Wheat Straw	12.5	1:2.8	2.0+4.0	150	15-17	1.0-2.5	17.0	18.5

TABLE No. 2.

PERCENTAGE OF LOSSES AT DIFFERENT STAGES

Raw Material Processed (MT.)	Pulp Recovered From Digesters MT.	Yield%	Screened Pulp Production MT.	Yield%	Bleached Pulp Production MT.	Yield%	Bleaching Shrinkage (%)	Centrifugal Screen Reject (%)	Unbleached Centricleaner Reject %	Bleached Centric-leaner Reject (%)	Machine's Centricl-eaner Reject (%)
75.000	38.572	51.43	35.293	47.06	30 000	40	15	5.0	3.5	1.0	1.0

EXPERIMENTS :

Experiments were carried out on plant scale in M/S Mukerian paper's Ltd. Mukerian. (Oswal group of Industries) for one month. Thorough studies were made in both the cases i. e. Alkaline pulping and Soda— AQ pulping. Sarkanda was properly cut through straw cutters to small pieces (20 - 30 mm) and fed into spherical rotary digesters through Lye-mixers with thorough mixing of chemicals. Results of pulping of Sarkanda with Alkali at 150°C temperature have been given on Table 1—3.

TABLE No. 3.

SODA-PULPING

BLEACHED PULP STRENGTH PROPERTIES

°SR	Tear Factor	Bulk (C.C./gm)	Breaking Length (Meters)	Final Brightness (%)
30-35	45-50	2.0-2.4	3000-3400	71-72

Anthraquinone was added by 0.05% into the digesters with proper prior mixing with Alkali in Alkali Dilution tanks through Lye-mixers. Dramatic change in the nature of pulp, K. No., and reduction of reject at different unbleached cleaning systems was observed. Results have been given on tables 4-6.

TABLE No. 4.

PLANT-TRIAL
SODA—ANTHRAQUINONE PULPING
COOKING CONDITIONS AND CHEMICAL CONSUMPTION

Raw Material	Chemicals Charged (%)		Bath Ratio	Cooking Conditions		K No.	R.A.A. (gpl).	Chemical Consumption (%)	
	Caustic	AQ		Cooking Time Hrs.	Cooking Temp °C			Chlorine	Lime
Sarkanda & Wheat Straw	11.50	0.05	1.0:2.8	2.0+3.0	150	14-16	NIL-1.5	15-17	17–18

*The Chlorine consumption during bleaching is high due to improper functioning of Brown Stock washing system.

TABLE No. — 5

SODA — ANTHRAQUINONE PULPING

PERCENTAGE LOSSES OF REJECT AT DIFFERENT STAGES

Processed Raw Material (MT.)	Unbleached Pulp Recovered From Digesters MT.	Yield%	Screened Pulp Production MT.	Screened Yield%	Bleached Pulp Production MT.	Bleached Yield%	Bleaching Shrinkage (%)	Centrifugal Screen Reject (%)	Unbleached Centricleaner Reject (%)	Bleached Centric-leaner's Reject (%)	Machine's Centricl-eaner's Reject (%)
75.000	40.650	54.20	38.820	51.76	33.00	44.0	15.0	2.50	2.0	1.0	1.0

— Gain in Pulp due to less rejection = 3.278 — 1.829 = 1.45 MT.
— Gain in Pulp due to better and uniform cooking = 40.650 — 38.572 = 2.078 MT.
— Total Pulp Gained = 3 528 MT., Unbleached and Screened Pulp.
— Total Bleached Pulp Gained = 3.528 — 15% Shrinkage losses = 3.000 MT. i.e. 4% Bleached Yield.

TABLE No. 6
SODA-ANTHRAQUINONE PULPING
BLEACHED PULP STRENGTH PROPERTIES

°SR	Tear Factor	Bulk (C C./gm.)	Breaking Length (Meters)	Final Brightness (%)
28-32	42-45	1 8-2.2	3200-3500	72-74

ANTHRAQUINONE MECHANISM

The chemical mechanism of alkaline AQ pulping is fairly well known with AQ being described as a Redox catalyst. The AQ while being reduced to AHQ Oxidises the reducing and group of cellulose and hemi celluloses, thus preventing the peeling reaction in Alkali and enhances the pulp yield. AQ is regenerated from AHQ by reaction with lignin.

MAJOR STEPS TAKEN TO ACHIEVE HIGHER YIELD

In addition to soda-Anthraquinone pulping following steps were taken to achieve higher yield.

(a) REFINING SYSTEM

Conical refiners were installed in unbleached straw pulping circuit to reduce rejections from centrifugal screens and unbleached centricleaners. Raise in °SR due to refiner observed 3 to 4, which was not high so and is managable, After installing conical refiner, Johnson screen hole diameter was increased as high as 14 mm In this way Johnson screen reject was found negligible. Centrifugal screen reject was recirculated through digesters. The flowcircuit of unbleached refining system is shown in Fig. 1.

REFINER FLOW SYSTEM DRAWING

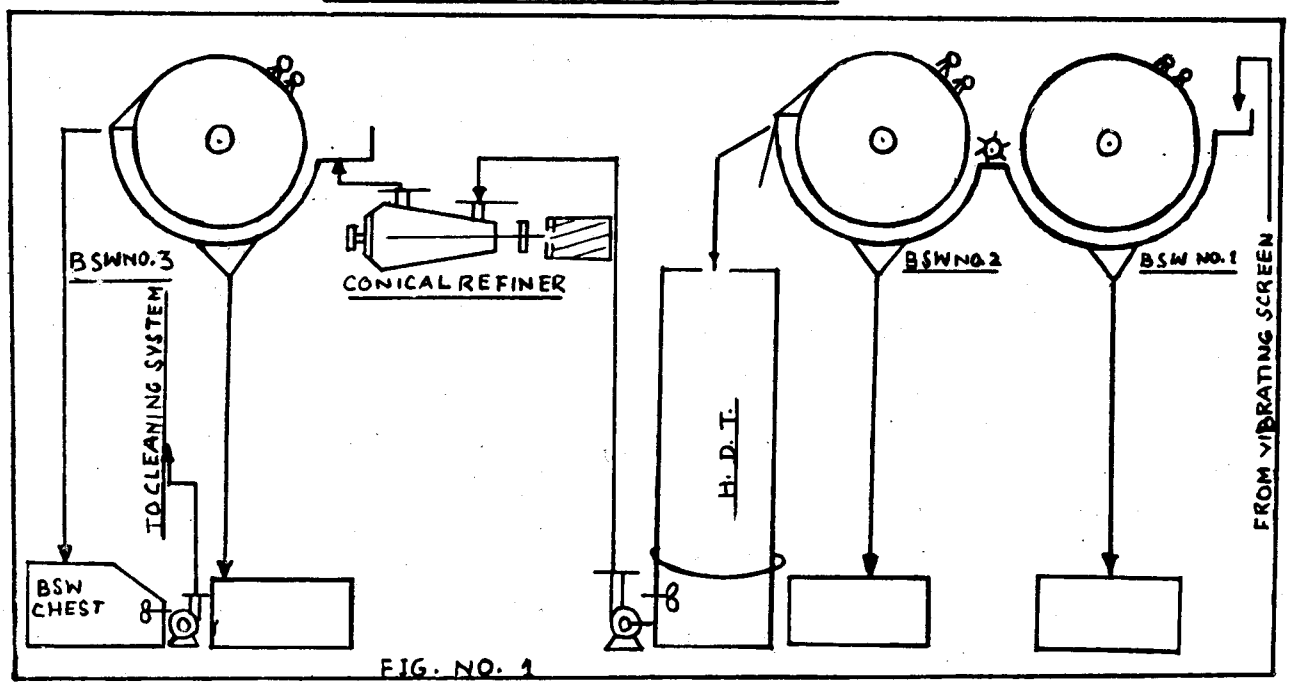


FIG. NO. 1

(b) Fibre Losses Through Decker Thickners

Back water ppm of Decker thickners was maintained 300 to 400 ppm, with proper maintenance of their sealing belts and wire cloths. Driveside sealing belts of Decker thickners was remained and made closed to reduce the Back water ppm.

(c) Holes In Wire Cloth Of Vacuum Washers

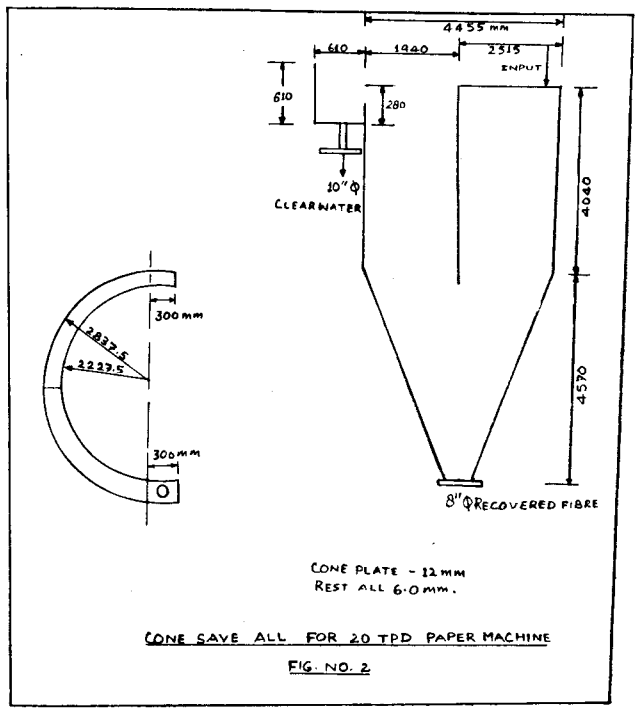
Wire clothes condition of vacuum washers is being checked shiftwise and maintained properly, because under vacuum it losses tremenders fibre.

(d) M.F. Machine Couch-PIT Pump Stand By

Formerly we had no stand-by pump for M.F. Machine couch-pit, which caused tremendous fibre losses in case of pump failure. Stand-by pump was installed and huge amount of fibre was saved.

(e) Cone-Save All

Cone-save all was, installed for fibre saving from M G. Machine back water. Drawing of Cone-save all is given below. Inlet ppm of Cone-save all was observed 1000 ppm and 100 ppm of drain back water. It was found very useful due to its easy operation, no man power and mechanical device is desired to operate it. Fibre recovery is 1.200 MT/day from Cone-save all. Fig. No. 2·



CONE SAVE ALL FOR 20 TPD PAPER MACHINE

FIG. NO. 2

DECAYING OF RAW MATERIAL

1. Elevated platform were made in the yatd to save raw material from decaying.

CONCLUSION

1. The rate of delignification during Soda cooking with AQ is higher.
2. Dissolution of Carbohydrates occurs at a lower rate with Soda-AQ pulping. Slower dissolution of Carbo-hydrate suggests that the peeling reactions (degradation or reducing Sugar end groups and cleavage of cellulose and hemicellulose) are suppressed in presence of AQ.
3. Bleached pulp yield increased.
4. Rejection at difierent unbleached stages reduced to great extent.
5. Chlorine and lime consumption reduces by 2-0% and 1.5%
6. Viscosity of pulp is higher in alkaline — pulping.
7. Alkaline + AQ pulping have a lower tearing resistance, which can be supplemented by increasing little long fibre.
8. High cost of AQ is still the main factor why it has not been used widely in the industry.

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