Production of Bagasse Based Papers On High Speed Machine and Quality Assurance

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Preamble

With dwindling supplies of conventional forest based raw materials, the only dependable raw material available for paper making in India for large sized news paper mills is bagasse.

Bagasse being short fiber and relatively weak furnish, it is found difficult to run bagasse furnish on conventional fourdrinier machines even at moderate speeds to produce bagasse based papers viz cultural and newsprint grades at high machine speeds and efficiency, selection of stock preparation equipment and paper machine is very important and the same is discussed below.

Stock Preparation

Bagasse pulp being slow draining pulp, does not require additional refining in stock preparation except for control refining of mixed furnish viz bagasse hardwood and broke etc. DD refiners with automatic programmable controls are desirable for control refining. Watt sensitive controller provides automatic adjustment of disc spacing for startup and to hold preset power during normal operations. It is advisable to provide surge towers following blend chest and machine chest. With bland chest surge tower, it is possible to utilise better furnish component for sweetner stock. Similarly, machine chest surge tower ensures immediate utilisation of ove head stuff box recirculation stock. Polydisc saveall is ideal for fiber recovery from excess machine back water. A lot depends upon the inherent design features of sectors, unit drainage capacity, shaft, shower etc of polydisc saveall.

We are happy to state here that our polydisc saveall supplied by M/s Hedamora, Sweden, is performing excellently in terms of drainage capacity clarity and sweetner demand.

For high speed machines, extensive instrumentation for stock proportioning, consistency and level control is a pre-requisite.

Approach Flow System

The most important requirement in approach flow piping particularly from primary centriscreen accepts to headbox is absolutely burr-free smooth inner surface. To avoid recurring problem of slime breaks, it is necessary to follow supplier's recommendation of average roughness not exceeding 125 microinches.

Practically, the inner surface of piping between centriscreen and headbox should be of mirror finish. As far as possible joints should be reduced, wherever jointing is a must, it should conform to smoothnes requirement of pipe.

Deculator system achieves deaeration of stock and thus machine problems relating to foam are avoided. Further, because of high vacuum, centricleaners operation is trouble free.

Paper Machine

For high speed paper machine operation with bagasse furnish, it is recommended to opt for twin wire formers. The twin wire formers have following main advantages over conventional foudrinier machines.

— Increased productivity due to higher drainage capacity per unit area and improved process control.

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— Improved quality of the paper, essentially better formation, less linting, less two sidedness
— Lower power consumption
— Ease of paper making operations
— Less space requirement

Headbox

Headbox is an integral part of forming section. The most important requirement for headbox are :

— It should produce an excellent CD basis weight profile
— It should produce a very stable jet
— It should produce an excellent degree of fiber dispersion
— Easy maintenance and operation

Tamil Nadu Newsprint and Papers Limited (TNPL) has installed a Bel-Baie II former with converflow headbox. TNPL produces Newsprint, P & W, SS grades with bagasse as main furnish. The furnish constitutes of :

	Mechanical Bagasse	Chemical Bagasse	Hardwood
Newsprint	50%	35%	15%
P&W grades	—	75%	25%

With bagasse furnish it is absolutely necessary to have efficient wire cleaning and roll doctoring devices. TNPL has installed a DST self adjusting doctor to breast roll. The DST doctor consists of blade and a holder which sits tightly to doctor back. Integrated rubber seal between the holder and the back prevent water leakage. Backing and carrying wire is cleaned with VHP needle shower of 35 kg/cm^2. It is our experience that inefficient wire cleaning results in wire marks and water spots. Wire cleaning has been made more effective by installing sheet wetting shower in the ingoing nip of wire turning roll. The former has been provided with mist exhaust system to improve visibility in former section.

Press Section

The standard press configuration for high speed newsprint machines running on weak furnishes like bagasse is trinip. The advantages of nodra w or trinip configuration are too well known to be elaborated further. However, for pure writing and printing machine it is advantageous to go for suction pickup combined with binip press followed with straight venta press and a smoothening press. The straight venta press with top granite roll ensures smoothness for top side. Similarly, smoothening press imparts additional smoothness.

TNPL press configuration is trinip. In order to take care of low wet web strength of bagasse furnish, a steam box after first nip has been provided on suction press roll prior to second press nip. Steam connection has been provided to backwater silo. The backwater temperature is around 43°C. Back water heating assists in efficient dewatering. Since dryness at TNPL after trinip press is of the order of 41-43%, steambox has not yet been put to use.

Dryer Section

It is necessary to have single felt layout or serpentine felt for first group cylinder for weak furnishes eventhough from world standards our high speed machines are really moderate speed machines. Perhaps single felt layout provides much needed support for sheet at its weakest point and allows for easy broke disposal. Sheet flutter is obviously curtailed.

The dryer section of TNPL machine is provided with single felt layout for first group of cylinders. Further, a grooved felt roll is incorporated into first group screen to ensure better sheet support between granite roll and first dryer. The draw between press and first dryer was optimised by modifying the framing for felt roll. Thus the sheet is totally supported from the amount it is formed through to the end of first dryer section with the exception of short open draw after press. The remaining three dryer sections (two before inclined size press and one post dryer section) are arranged in double felted manner. However, the second section incorporates Beloit low profile configuration, which reduces the open draw length of the sheet. The complete dryer section is enclosed with closed hood including basement hood. Pocket ventilation ducts have been provided. Further, air deflectors in dryer screen runs reduce air currents and thus assist in avoiding sheet flutter.

Steam and Condensate System

The steam and condensate system is a cascade system with facility for switching to two/three stage cascading system depending upon production rates. For steam control, the top and bottom cylinders ofifirst group are grouped separately. The principle being to steam the bottom dryers (low condensing rates) at a lower steam pressure than the top dryers (high condensing rates), so as to maintain the same cylinder surface temperature. Similarly, post size top and bottom cylinders are grouped separately for curl correction control. For curl correction, differential drying rates are applied as top and bottom row of post size press cylinders are each under separate pressure control and each of row has its own differential pressure control and condensate collecting vessel.

It has been found that steam and condensate system of TNPL is very efficient and steam consumption for dryer section inclusive of hood is less than 1.7 t/t of paper. TNPL dryer breaks are minimal.

Calender Section

A four roll stack with fixed queen roll is provided for TNPL machine. The calender stack has been provided with variable crown rolls at bottom and intermediate roll position. Calender stack is equipped with chilled air nozzles for maintaining good caliper profile.

Pope Reel

The pope reel design provides control of nip pressure at all stages of reel build-up. This results in good quality jumbo reels being produced.

Winder

For high speed operations, winder opeations are very critical in terms of quality and quantity of reels produced. The winder should be capable of constantly performing trouble free windup operations two and half times machine opeating speed. The final quantity of reel coming out of winder is to a great extent dependent upon winder operations.

Beloit has provided their two drum high speed winder to TNPL. The performance of winder is very good.

Process Control

TNPL has installed Model Micro 1180 AccuRay process control system for paper machine. The process control is computer based and some of the features are :

— Basis weight control
— Moisture control
— Rush/drag control
— Speed optimisation control
— Auto grade change

Hard copy report comprising	:	Reel report Grade report
Video display comprising	:	Process trend Cross machine profile Process summary Production summary

Accuray control system has been found to be very useful in day to day operations. I think the investment in process control is justified for high speed machines.

QUALITY ASSURANCE

Pulping

The first step for quality assurance lies in proper raw material management through proper depithing and wet pile preservation. Good depithing ensures the proper quality of bagasse by way of less colour reversion aud minium deterioration. For depithed bagasse it has been observed that fibre to pith ratio should be maintained 3 : 1 to ensure adequate depithing

During cooking of chemical bagasse pulp, addition of kraft liquor, temperature and retention time are closely maintained to maintain Kappa Number at 10/11 and to limit the shive count to 2—3%. The residual active alkali is maintained around 4—5 gpl to ensure uniform cooking. The bleachability for chemical bagasse pulp has been found to be quite good with total chlorine of 6.5—7.5 in C-E-H sequence. We are able to get bleached chemical bagasse pulp of 76—77% EL. The viscosity at this brightness varies between 9-11cp. Hardwood cooking is performed in batch digester with 20—22% white liquor of 20—25% sulphidity. The Kappa Number is maintained strictly around 19/21. For production of lighter gsm Printing & Writing

paper, Eucalyptus grandis is found to be better than Eucalyptus tereticornis (Hybrid). The viscosity at final stage is maintained 5—7 to ensure reasonably good quality pulp suitable for refining at stock preparation and to provide adequate wet web strength.

The pH at various stages of pulp production are closely monitored for maintaining optimum viscosity and strength.

By proper raw material management, it has been possible to reasonably good quality mechanical pulp for the production of newsprint even at 700—750 m/min. Experiments are being conducted to preserve the bagasse quality during the storage life i e. over six months through applications of bio-technology.

By proper control of refining, it has been able to achieve production of mechanical pulp with reasonable strength and good opacity. The newsprint opacity (printing) of 92/93% has been achieved which conform to international specifications.

In order to preserve maximum strength of mechanical and chemical bagasse pulp any post refining at stock preparation has to be excluded.

The final brightness of mechanical bagasse pulp is highly dependent on age of bagasse. Depending upon the age of the baggase, the brightness of mechanical bagasse has been achieved 35–50% EL with 1.0–1.5% peroxide. The typical properties of TNPL newsprint, creamwove and maplitho (S3) are given in Table–1, Table–2 and Table–3.

Paper

Due to twin wire configuration following advantages have been experienced:

1 Less two sidedness in paper.

2 Good formation

For day to day quality monitoring, following features have been found to be more useful for maintaining paper quality.

1 Control of jet/wire speed ratio for monitoring ultimate paper properties like breaking length. Depending upon the grammage and properties required for paper the MD : CD breaking length can be varied from 2.5–3.1. This has attributed to better operation (high speed) at winder.

2 Comparatively low tear of paper due to chemical bagasse pulp is compensated by hardwood pulp with relatively higher tear.

3 Less moisture variation due to Accu Ray control which keep the paper curl free. We do not have any curl even for our surface coated paper for which production has been taken up very recently. Response from the printers is also quite good.

4 The cascade control of steam in drying section also contributes to maintain uniform moisture.

5 Bulk of the paper is comparatively low due to low bulk of chemical bagasse.

6 The opacity and other test parameters have been able to meet the ISI specifications for all varieties of paper.

Freeness, Consistency and Fiber Classification

In general, freeness at machine headbox is attained around 260 csf for Printing & Writing paper. The converflow box freeness is maintained around 100 csf to ensure better runnability. The consistency at converflow is maintained at 1.0–1.2% for Newsprint and 0.9–1.0% for Printing & Writing paper.

Printing Result

The print quality, show through, ink absorption etc have been found to be quite encouraging for making high quality Printing & Writing paper and are quite comparable to others. It has been able to achieve higher VVP about 2200–2800 for creamwove paper which proves beyond doubt that such paper is quite suitable for high speed and high quality printing.

Wet Web Strength

The wet web strength for TNPL Newsprint furnish is 0.6–0.65 Nm/g. and for Printing & Writing paper the same varies to 0.9–1.0 Nm/g.

TABLE—1

PROPERTIES OF CREAMWOVE PAPERS

S.No.	Particulars	Unit	TNPL	Mill-A	Mill-B	Mill-C	Mill-D	Mill-E	Mill-F	Mill-G
1.	Basis Weight	g/m²	60	60	62.5	59.5	60	57	60	62/60
2.	Caliper	mic	78/85	80	85	87	78	89	—	103
3.	Bulk	cc/gm	1.30/1.42	1.33	1.36	1.45	1.34	1.47	—	1·59
4.	Ash	%	11.0	16-18	15.8	6.0	—	11.0	—	—
5.	Moisture	%	5.6	4.5	—	—	—	—	—	—
6.	Brightness	%EL	71.7	70 6	62 2	72 2	71.5	67.9	63.1	58.5
7.	Yellowness	%	–4.0	–1.1	3.5	–4.6	—	–3.3	–18.7	–6.7
8.	Opacity	%	89.5	88.0	95.2	95.0	90.0	92.4	98.1	98.7
9.	Breaking									
	Length–MD	metre	6120	4900	3720	—	3530	3430	—	4090
	–CD	metre	2570	2500	2250	—	2380	1790	—	2030
10.	Tear Factor–MD	metre	37	50/60	53	—	29	45	—	44
	–CD	metre	47	60	54	—	33	53	—	53
11.	Burst Factor	Nos	18	14	13	—	13.1	16	—	14
12	D F	Nos	15/10	10/5	—	—	4/3	—	—	8/4
13.	Smoothness	m/min	220/90	140/120	260/160	130/160	530/390	250/150	290/465	850/600
14.	Porosity	m/min	100	575	910	850	595	500	905	1000
15.	Cobb Sizing	g/m²	25/24	18/20	—	—	18//19	—	—	30/29

TABLE—2

PROPERTIES OF MAPLITHO & OFFSET PAPERS

S. No.	Particulars	Unit	TNPL SS	TNPL SS	Mill-A Maplitho	Mill-C Offset	Mill-E Maplitho	Mill-F Maplitho
1.	Substance	gsm	60.0	70.0	81.0	57.9	64 8	63.0
2.	Caliper	mic	71	84	99	76	93	78
3.	Bulk	cm³/gm	1.20	1.20	1.22	1.31	1.44	1.24
4.	Ash	%	17.5	16.7	18.0	12.5	12.0	15.2
5.	Smoothness	ml/min	150/85	175/90	160/90	170/90	180/125	90/75
6.	Porosity	ml/min	90	60	310	920	690	430
7.	Brightness	%	72.8	73.5	71.0	82.0	71 0	74.7
8.	Opacity (print)	%	90	91	97.2	83.1	96.6	92 5
9.	Yellowness	%	–13 0	–13.8	–12.9	–0.0	–10.8	–4.0
10.	Shade		Blue	Blue	Blue	Whitish	Pink	Pink
11.	Cleanliness		Fair	Fair	Good	Gocd	Satisfactory	Good
12.	Formation		Good	Good	Cloudy	Good	Cloudy	Fair
13.	End User		Varnishable lable printing	Varnishable calender	Album Xerox paper varnishing	For making diary	Lable printing	Lable printing 70 gsm for calender

TABLE—3

COMPARISON OF BAGASSE NEWSPRINT WITH WOOD BASED NEWSPRINTS

TYPE :		Softwood Newsprint	Hardwood Newsprint	Bagasse Newsprint	Bagasse Newsprint
SOURCE :		Canada (Powel River)	India (Kerala)	Argent na (Tucuman)	India (TNPL)
Basis weight	gsm	48.2	51.4	49.6	50.6
Caliper	mic	85	81	67	85
Sheet Ash	%	1.0	3.0	14	9.2
Breaking length (MD)	metres	4450	5970	4150	3520
Burst factor		12	20	11	11
Tear factor (CD)		52	56	61	44
Printing opacity	%	93.5	91	88	93.5
Scattering Coefficient	cm^2/g	484	401	437	450
Absorption Coefficient	cm^2/g	47	43	26	50
Brightness	°GE	58	48	59	50.5
Furnish Composition		TMP 85% SBK 15%	CMP 70% HWP 30%	SCBP 75% GWP 15% SBK 10%	MBP 50% CBP 35% HWP 15%
Machine speed	mpm	1100	600	600	630

Note : TMP = Thermo Mechanical Pulp
CMP = Chemi Mechanical Pulp
SBK = Semi Bleached Kraft
MBP = Mechanical Bagasse Pulp
SCBP = Semi Chemical Bagasse Pulp
HWP = Hard Wood Pulp (Bleached)
CBP = Chemical Bagasse Pulp
GWP = Ground Wood Pulp