

# Advances in Coating Technology and Suitability of Bagasse Furnish for Base Paper

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*ABSTRACT:- This paper outlines various advances in coating technology. The properties of bagasse based base paper are discussed. The advantages of higher sheet density and lower porosity of base paper with bagasse furnish are highlighted.*

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## INTRODUCTION

The purpose of coating is to impart a smooth, uniform and receptive surface for printing, which at the same time will improve the optical properties. The objective of coating is to obtain the most uniform coverage possible at a given coat weight. Best possible coverage of the paper surface at a given coat weight can be obtained by holding as much coating as possible on the surface of the paper. This depends on the proportion of coating which remains on the paper surface without penetrating into the base paper. The variables affecting the penetration of coating formulation into the base sheet and the possibility of using bagasse furnish in coating base with the advances in technology are discussed in this paper.

## VARIABLES AFFECTING THE PENETRATION OF COATING FORMULATION

1. Solids content of the coating formulation
2. Type of coater
3. Method of drying
4. Base paper characteristics

## SOLIDS CONTENT OF THE COATING FORMULATION

The penetration of coating formulation will be reduced by increasing the solids content in the formulation. With the invention of synthetic binders the

solids content in the range of 70% is possible. With higher solids, the immobilization point can be reached quickly. No Penetration occurs after this point. The point in the coating process where immobilization occurring can be different depending on the composition of the coating formulation. For coating formulation containing calcium carbonate this occurs at about 78% solids and for formulation containing clay this occurs at about 74% solids.

## TYPE OF COATER

The coaters are broadly divided into four types. They are Air knife coater, Transfer roll coater, Blade coater and Combination coater.

### Air Knife Coater

The speed of the coater is an important factor. The time available for penetration is inversely proportional to the speed of the coater. The air knife coater is a low solids (40-45%) and low viscosity operation. The air knife gives a uniform film thickness by following the contours of the paper. Large drying capacity is required due to low solids operation. The speeds of these coaters are up to 600 m/min. Coat weight can be varied from 7 to 20 gms. These coaters are less sensitive to base paper imperfections. At present these are mainly used for coating paper board.

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## Transfer Roll Coater

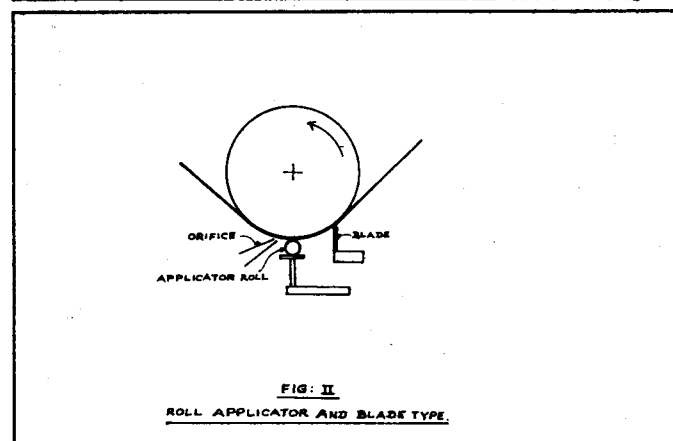
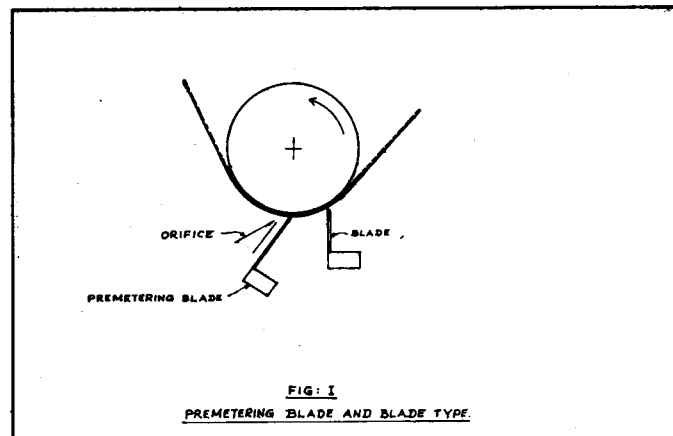
The transfer roll coaters are suitable for on-machine coating. Speeds up to 600 m/min. are possible with these coaters. Solids content can be as high as 65%. But with higher solids this gives film splitting pattern on paper. This type of coaters are suitable for light weight coating.

## Blade Coater

The blade coaters can handle higher solids with less problem. Their operating speed is over 1000 m/min. The problems with blade coater are streaks and breaks due to base paper defects. They require base without any blemish and with uniform caliper. The quality of the blade coaters has improved by modifications. Important types of blade coaters are flexiblade, bill blade and short dwell coater.

## Combination Coater

Combination coaters provide better runnability as well as quality. The advanced types are i) Premetering blade and blade type (Fig.I) and ii) Roll applicator and blade type (Fig II). In the premetering



blade and blade type the coating is applied through a distribution system to a slot orifice extending the entire width of the machine. Premetering by blade eliminates splashing and film splitting. The operating speeds are up to 1300 m/min. In the Roll applicator and blade type the color is supplied from one side to the distribution pipe with holes in the cross direction to maintain even flow across the width. The coating is applied to the sheet, just ahead of the premetering roll. The gap at the nip is about 1.0 mm and this reduces dewatering of the coating color at the nip. The amount of preapplied coating is controlled by the gap. The applicator roll and blade are located closely to reduce the time of penetration. The operating speeds are over 1500 m/min.

## METHOD OF DRYING

Faster drying is required to reach the immobilization point quickly. For this Infrared dryers are used. The advantage of using infrared dryers as compared to convection, or flotation drying is the ability to transfer heat into the sheet at higher rates without surface drying the coating, which results in an improvement in quality. After the immobilization point, post dryers are used for drying the sheet in on-machine coaters.

## SHEET CHARACTERISTICS

Good formation is a requirement for coating base. Porosity of the sheet is an important factor which affects the penetration. The penetration is directly proportional to the porosity of the sheet and is inversely proportional to the sheet smoothness. Surface sizing and internal sizing reduce penetration.

## COATING BASE WITH BAGASSE FURNISH

SPB is having an air knife coater of 30 tpd capacity (chromo). At present the base is being made from wood furnish with surface sizing. The belief that poor quality base paper can be coated to cover-up of defects is not true, as defects of base sheet are often magnified on coating. For this reason the base paper should be of exceptional quality. Lower bulk and porosity of base paper are advantageous for coating purpose. Base paper made with bagasse furnish has both these qualities, i.e., denser sheet and lower porosity. Trials were conducted with bagasse furnish (80%) in the base sheet without

surface sizing. Table I shows the results of wood furnish and Table II the results of bagasse furnish. The bagasse base sheet has a porosity of 700 ml/min (60 gsm) while corresponding wood base sheet has a porosity of 1200 ml/min even after surface sizing. After coating the porosity of both sheets were 200 ml/min. Gloss and picking strength were comparable. These indicate that base sheet can be made with bagasse without surface sizing. Another advantage is sheet made from bagasse furnish is smoother than the sheet made from wood furnish. This helps to cover more area of the sheet with comparatively less coat weight. The disadvantage with bagasse sheet is the opacity. Lower opacity of base paper affects the opacity of coated paper after supercalendering.

**Table-I**

<b>Properties of base and chromo paper (Wood Furnish)</b>			
Property	Unit	Base	Coated
Substance	gsm	60	74
Caliper	mic	90	85
Bulk	cc/gm	1.50	1.15
Smoothness	ml/min	160-220	25-35
Porosity	ml/min	1200	200
SOA	sec	2	1000
Waxpick (F/B)	no.	11/11	6/11
Cobb Sizing (F/B)	gsm	22/22	32/22
Brightness (F/B)	%	73/73	75/72
Opacity	%	89	96
Gloss (UEC)	%	10-12	56-64
Ash	%	2.0	16.1
Burst Factor		24	22
Tear Factor		55	41
Breaking Length (MD)	m	6800	6600
Breaking Length (CD)	m	3500	3300

**Table-II**

<b>Properties of base and chromo paper (Bagasse Furnish)</b>			
Property	Unit	Base	Coated
Substance	gsm	59	72
Caliper	mic	78	72
Bulk	cc/g	1.32	1.00
Smoothness	ml/min	140-160	20-30
Porosity	ml/min	700	200
Surface Oil Absorption	sec	8	1000
Wax pick (F/B)	No.	7/7	5/9
Cobb Sizing (F/B)	gsm	20/21	33/20
Brightness (F/B)	%	73/73	75/71
Opacity	%	86	93
Gloss	%	10-12	62-67
Ash	%	10.0	24.0
Burst Factor		19	16
Tear Factor		40	30
Breaking Length (MD)	m	5900	5000
Breaking Length (CD)	m	2700	2200

## SUITABILITY OF BAGASSE FURNISH FOR ON-MACHINE COATING

On-machine coating has many differences when compared with off-machine operations. One of them is the property of base sheet entering the coater. The sheet entering the coater in an off-machine coater is calendered and surface-sized. The temperature of the sheet is comparable with room temperature. But the sheet in on-machine coating is not surface sized nor calendered (before coating). Also the temperature is higher than the room temperature. The higher temperature reduces the viscosity of the coating formulation. With the porous sheet and low viscosity formulation the penetration is high. Further the smoothness is lower than the calendered sheet. Lower smoothness needs more chemical for uniform application. The penetration of coating formulation in an on-machine coater can be reduced by having a sheet of less porosity and higher smoothness. Thus the sheet made from bagasse furnish having less porosity and higher smoothness can be used for on-machine coating.

## ADVANCED TECHNOLOGY FOR ON-MACHINE COATING WITH BAGASSE FURNISH IN THE BASE PAPER

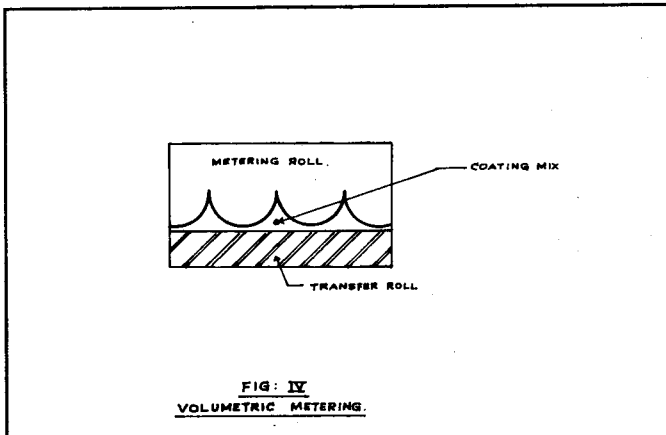
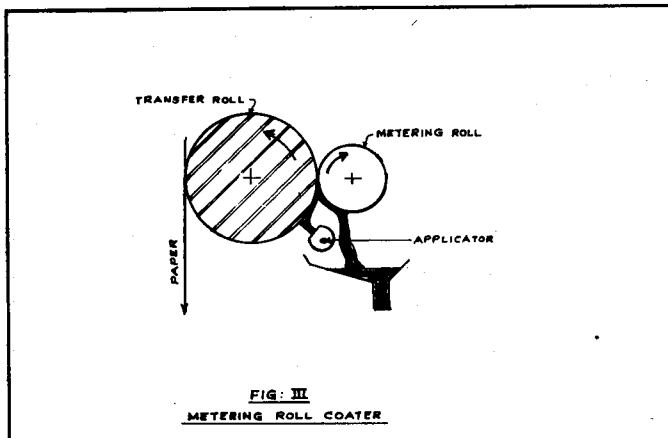
### Properties of Bagasse Paper

- \* Paper made from furnish containing bagasse fiber is more dense and of closed formation because it contains more hemicellulose which improves the bonding index when compared to other conventional fibrous raw materials.
- \* The hydration of bagasse pulp is higher even prior to refining. The bagasse pulp absorbs refining energy readily and hydrates faster.
- \* Due to superior bonding potential, paper made from bagasse furnish is characterized by superior bonding and low porosity.

The low porosity and better smoothness are advantageous for on-machine coating. This favours two side coating particularly with different color coating on both the sides. With light weight coated grades this is very important as penetration will lead to show through of color on the other side. The disadvantages of bagasse furnish are the lower tearing strength and opacity.

## Metering Roll Coater

Few of the coaters are suitable for weak webs and surface located coating. One of them is metering roll coater (Fig. III). The operating speeds of these coaters are over 1500 m/min and the solids content in the formulation can go upto 60%. In metering roll coater the application is by means of a fountain application, to ensure that the coating is evenly distributed over the entire width of the transfer roll.



## Metering

Premetering is performed by the metering roll, normally an wire wound roll with spiral shaped groove pattern. The thickness of the wire varies depending on the application. The diameter of the wire is about 0.4 mm for coat weight applications in the range of 12 to 15 gms. Premetering is volumetric (Fig. IV). The quantity of coating color metered is an exact function of the space between the roll and the transfer roll. This avoids the negative hydrodynamic effects occurring with other systems. The speed of the roll is slower than the transfer roll.

Normal speed of the metering roll is 30-40 m/min. The wire on the roll has to be replaced after 8 to 12 weeks depending on the application.

## Transfer roll

Transfer of the coating mix to the web is achieved with the help of a rubber-covered steel roll. Soft rolls are used in order to achieve a surface located coating. The speed of this roll depends on the machine speed. About 90% of the premetered coating is transferred to the web. All the rolls are water cooled. Coat weight can be varied from 2 to 15 gsm per side.

Market needs higher qualities in lower basis wt. Metering roll coater fulfills this purpose. In this coater both sides can be coated simultaneously. Two different colors can be applied on both the sides. Drying is done by Infrared dryers and air turn system is used to dry the sheet sufficiently before the sheet contacts the post dryers.

## Opacity and Bagasse sheet

The opacity of bagasse sheet is low when compared with sheet made from wood furnish. To reduce this effect fillers may be used. But using fillers will reduce the strength of the sheet. The opacity is further lowered if the sheet is supercalendered. One way to avoid the reduction in opacity is by employing soft nip calendering techniques. When both sides are coated simultaneously Back-to-Back 2 x 2 - Roll Soft Calender with top and bottom swimming rolls can be used. Soft nip calender finishes the sheet with even density. Other advantages are improved opacity and bulk retention due to lower specific nip pressures. A wide range of finishes are possible on one machine from matt through to high-gloss. But soft nip calendering needs some base sheet properties. CD base sheet variations are a problem for all calendering operations. With soft nip calenders, base sheet uniformity is especially important because of the difficulties in manipulating CD caliper with resilient covers. The CD base sheet requirements for soft nip operation are:

- A CD bone dry weight 2-sigma variation of less than 0.5% of process.
- A peak-to-peak moisture variation of less than 1%.

Meeting or exceeding these standards is clearly

a requirement for good quality with all soft nip operations.

### **CD Caliper profile control technology for the soft nip calender**

Induction heating system is the latest technology used for soft nip calenders. With ac induction, a high-frequency, alternating power source induces eddy currents to the surface of the solid metal roll, causing sectionalized roll heating and expansion.

### **CONCLUSION**

The higher density and lower porosity of the base paper made out of bagasse furnish are advantageous for coating. The draw back of lower tearing strength can be overcome by the selection of suitable coater. The lower opacity can be taken care of by the use of soft nip calendering technique.

### **ACKNOWLEDGEMENT**

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