

# Successful Trials & Optimization of ASA Sizing

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## ABSTRACT

To sustain in the competitive market, it is inevitable to up-date the quality of product on a continual basis. In this direction, JK Paper LTD- unit Central pulp mill has introduced ASA sizing in both of machines from June 2007. During switch Over from Neutral sizing to ASA Sizing, CPM has to encounter many problems but, with the constant encouragement from the management, technical support given by chemical suppliers and dedicated spirit of our team members, CPM was able to solve problems.

## INTRODUCTION

Internal sizing is an important step in wet end process of the paper machines. The purpose of the sizing is to modify the surface of the paper to control water penetration as the fibers in the paper are very hydrophilic (water loving). Sizing is done either to limit the pick up at the size press and coaters or to render the final product with water, ink and other aqueous liquids resistant. The sizing agent inhibits or controls the penetration of liquids. The liquids can penetrate paper in two ways- Interfiber penetration is fluid penetration through the pores or spaces between the paper fibers and intrafiber penetration is fluid penetration through the fibers themselves. The sizing agent inhibits this penetration by providing a low surface energy layer on the paper fibers, which tends to repel the high surface energy liquids. In order to effect in this function, the molecules of the sizing agent must be well distributed throughout the paper structure and firmly anchored to the fibre surface. Here we will offer a general overview of ASA sizing process which CPM is following.

## Types of Internal Sizing

Boardly, sizing can be categorized into following three types

- ⇒ Acid sizing,
- ⇒ Neutral sizing
- ⇒ Alkaline sizing.- Alkaline paper making can be done through
  - ◆ AKD Alkyl Ketene Dimmer
  - ◆ ASA Alkenyl Succinic anhydride

## Acid sizing

In acid sizing, rosin is most widely used internal sizing agent & alum plays JK Paper Ltd., Unit Central Pulp Mills, P.O. Fort Sargadh, Dist. Surat, Gujarat

a very important and critical role in imparting sizing property to the paper / board. Alum serves as a precipitating and anchoring agent for the sizing and also serves as a retention aid for fines, fillers & improves drainage. In Acid sizing best sizing is generally achieved in 4.0-4.5 pH range. However, This depends upon individual mill operational conditions and furnish.

## Neutral sizing

This sizing systems is available where rosin base is still effective in the pH range of 6-7. The hydrophobic ingredient in the neutral sizing is inherently non-ionic and they hold no charge, and hence not greatly attracted to the cellulosic fibres. By incorporating specially designed polymers into the sizing chemical, it is rendered non-ionic. However, greater attention has to be paid to the wet end and its chemistry in order to optimize the chemical consumption and overall economics.

## Alkaline sizing

In the mid eighties, alkaline sizing emerged as the promising reactive sizing for alkaline paper making in alkaline medium and by nineties, ASA sizing also started competing with AKD as one of the major synthetic sizing agent, available for neutral and alkaline paper making i.e. in 6-9 pH range.

## Difference between AKD and ASA Sizing

### AKD

It is derived from waxy fatty acid and is less tolerant to the alum. It is simple to handle but there is some negative effects e.g. Slippage and higher static

current in the final paper. On machine cobb value can not be achieved until & unless it is heat cured.

## ASA

It is petroleum based oil product. Diluted emulsion shelf life is for few hours only where as undiluted materials shelf life is unlimited if properly preserved. It is emulsified with a cationic carrier like cationic starch or synthetic cationic polymer. ASA gives quick on machine sizing development and lower consumption. However consumption varies from mill to mill depending on fiber furnish, ionic charge and wet end configuration. To have efficient distribution and the retention of ASA in the wet paper web, retention aid is widely used. With poor retention or wild sheet formation chemical is carried over to the back water system which gives poor sizing and increasing specific of sizing consumption figures.

## CPM'S experience during switch over from Conventional Acid Sizing, Neutral Sizing, AKD to ASA sizing

### Problem in Acid Sizing

- Retards the affects of optical whitening agent
- Paper Brightness limitation
- Due to lower pH, colour reversion takes place resulting in yellowness of paper over a period of time.

Neutral sizing was introduced in CPM in the year 2000 and Neutral sizing rosin consumption was 13- 15 Kgs/Ton of paper along with non ferric alum consumption of 25-30 kgs/Ton of paper. During Neutral sizing pH was maintained 5.8-6.2.

- Excessive foaming problem
- Machine runnability disturbed
- More Paper Rejection

Comparative consumption of neutral sizing chemical and acid sizing chemical along with Paper properties is given below

### INITIAL PROBLEM

To avoid the above problems CPM replaced the ordinary petroleum based defoamer with silicon based defoamer and we switched over to 100% production of Neutral sized paper.

Further optimization of Neutral size chemical was done through following steps

- Addition of new additives in surface sizing
- Combination of low level of internal size chemical and

- controlled level of surface size
- Reduction in consumption of sizing chemical and sizing cost
- Online dozing of Neutral size chemical & additive

At CPM several trials were conducted with Alkaline sizing by using AKD as Indian paper mill need to adopt for competing in the Global market. To get the following improvements

- Improved strength through better fiber bonding and paper brightness
- Reduced corrosion due to Alkaline condition
- Improved runnability of Machine
- Better Printability

Particulars	Unit	Acid Sizing	Neutral Sizing
Fortified size	Kg/Tn	13-15 Kg	-
Neutral size	Kg/Tn	-	13-15
Non ferric Alum	Kg/Tn	40-45	25-30
Wax emulsion	Kg/Tn	4	-
Stock pH	-	4.3-4.6	5.8-6.0

### Problems faced with AKD

- AKD consumption was high compared to accepted
- Acute fines accumulation in lump breaker roll, paper roll after suction couch roll & press rolls
- Adversely affected runnability of Paper Machine
- As per Consumers feed back , Though brightness of paper was increased but paper was more slippery and as we manufacture more than 70 % copier grade paper, slipperiness effects largely at consumers end which CPM can not allow

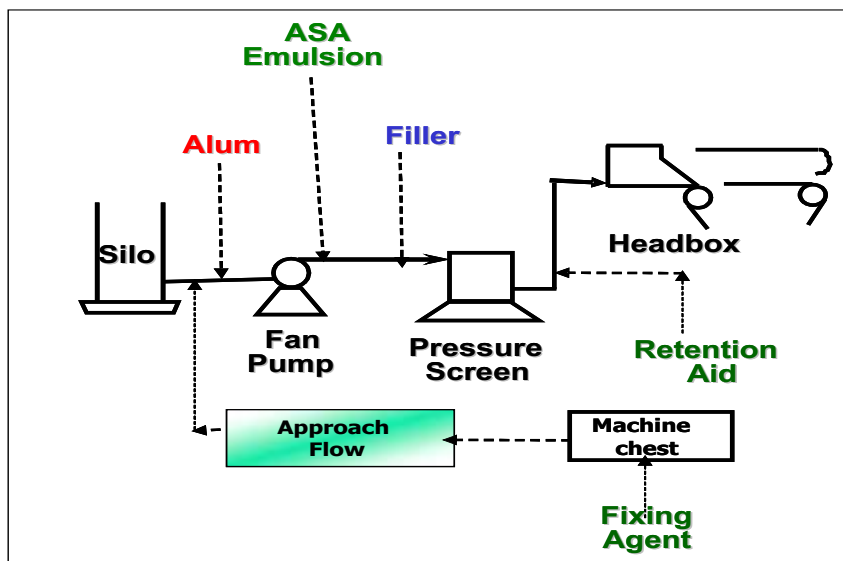
Parameters	Unit	Surface sized Copier grade paper – 70 gsm		Surface sized Maplitho- 70 gsm	
		Acid sizing	Neutral sizing	Acid sizing	Neutral sizing
Sizing	-				
Bulk	cc/gm	1.37	1.37	1.18	1.18
Ash	%	10.5	11.0	15.5	16.0
<b>Brightness</b>	<b>% ISO</b>	<b>85.5</b>	<b>86.5</b>	<b>85.5</b>	<b>86.5</b>
Opacity	%	91.5	91.7	94.5	96.5
Smooth ness (Bendtsen)	ml/min	160/207	160/209	90/120	90/125
Wax pick (TS/WS)	No.	10A/11A	10A/12A	10A/12A	10A/13A
Breaking length (MD/CD)	Meter	4040/2830	4150/2900	3644/2696	3755/2700
Burst factor	-	18.4	20	17.8	21.8
Double folds	No.	8/6	9/7	16/11	18/12
Tear factor	-	57/63	57/63	55/61	60/67
Cobb (one min)		19/21	19/21	19/21	19/21

Brightness of paper has increased by 1% ISO in Neutral sizing.

### Why CPM preferred ASA sizing

In tune with the changing demands of the customers for high bright papers with more whiteness and fluorescence , after few initial trials , with rosin based neutral sizing chemicals, CPM has two paper machine manufacturing writing & printing paper and taken a pragmatic decision of converting of both paper machines with ASA sizing from Neutral sizing in June 2007. ASA has more benefits compared to AKD , CPM opted for ASA alkaline sizing. Before taking up plant scale trials, number of lab scale experiments were conducted to identify suitable retention and sequence of chemical addition . In consultation with the ASA suppliers, CPM has worked out the sequence , points of chemicals application and finally evolved the system as depicted in Figures.

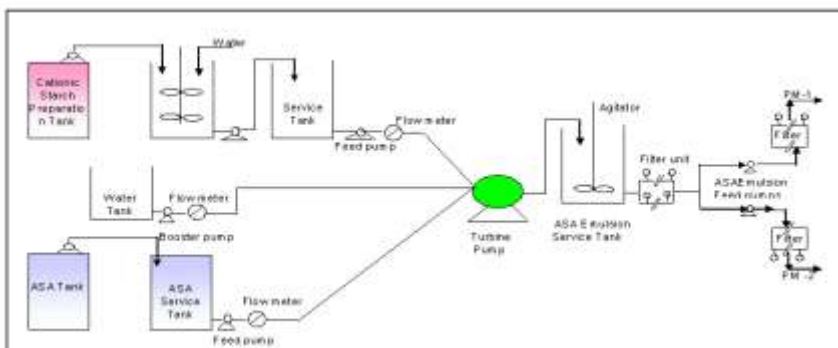
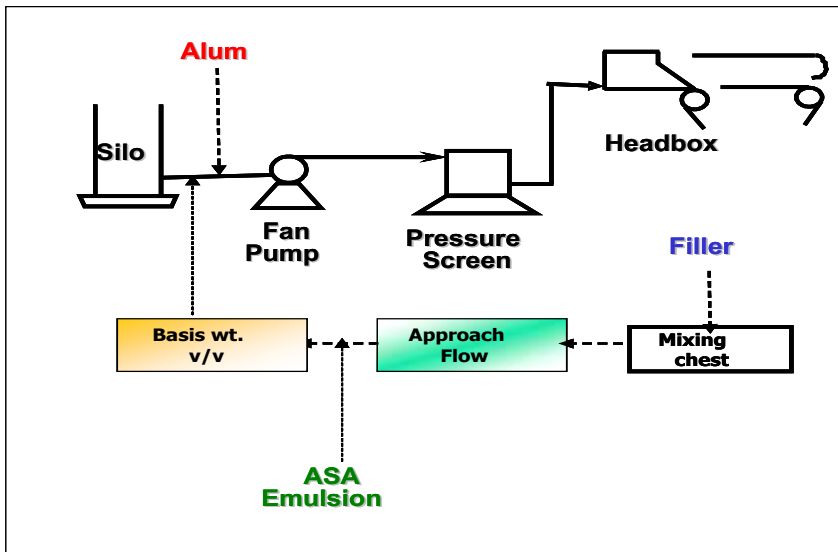
### Application points of Chemicals for Paper Machine 1



### System for Paper machine -1

ASA Sizing is running smoothly on PM 1 with ASA as per the application points of NF Alum , Fixing agent & retention aid .

## Application points of Chemicals for Paper Machine 2



### System for Paper machine -2

In PM 2 we started ASA sizing as per the same application points as followed in PM 1 but we faced Picking on lump breaker roll & Severe press picking in all the presses, particularly in 3<sup>rd</sup> press (unfelted press). Top soft rubber roll leading to machine breaks & Paper surface defects like tiny holes and fiber spots.

To resolve the above problems we initiated several discussions with ASA suppliers and their principal. At last we observed that paper machine configuration plays a very important role in stabilization of ASA sizing and their application points which suits with the configuration of machine. So CPM went with following changes as shown in the figure above.

After doing the above changes fiber picking was minimized and machine runability could be brought to the normal level of operation.

### Precautions taken during change over from Neutral sizing to ASA sizing

- Alkaline chemical boil out of the

system is carried out as sizing medium is changed.

- During ASA running acid boil out with sulfamic acid followed by alkaline boil out is being carried out after 30 days of machine running to avoid the slime growth.
- ON-line anti slime control programme is running & monitoring of total bacterial count is done in every 15 days.

### ASA EMULSIFIER - Preparation and Feed system

ASA must be dispersed into of fine particles for use in a paper machine system. ASA sizing agents emulsified on-site. The methods employed high pressure equipment as turbine pumps. This method of emulsification is very simple and reliable.

### Handling and monitoring

To make dosing system more user friendly and minimize the unnoticed stoppages of individual chemical dosing pumps, a fool proof full dosing system with alarms for failure of any pump and also with required chemicals filtering and on- dilution facilities were provided in consultation with the respective chemical suppliers

## Training

To make the operating crew competent enough to handle the new chemicals dosing system including the safety aspects all the concerned were trained with the help of the respective chemical suppliers.

Internal shop floor training sessions were conducted to make the operating crew conversant with the process variables in new ASA system

## Benefits Derived

CPM observed following benefits with ASA

- Overall economy.
- Higher brightness with more whiteness and glow, lesser brightness reversion. CPM achieved paper brightness of 93+1% ISO with ASA.
- Fluff generation in dryer groups eliminated.
- Eliminates slipperiness of paper.
- On-machine cure provides a stronger sheet leading to better runnability.
- Hard drying prior to size press not required to achieve internal sizing.

## CONCLUSION

Choosing suitable application points of different chemicals and close monitoring will help to optimize the overall alkaline sizing chemicals consumption with cost effectiveness. The planning should start with company long terms goals and how alkaline sizing paper can help to achieve this goal.

Before starting the trials their must be strong commitment from management which should be a commitment for time, money and total back up for the project.

Optimizing drying profile, ASA consumption can be minimized and always less consumption of ASA is good as probability of Hydrolysis of ASA will be very low.

Definitely, alkaline paper making helps to improve the optical properties of paper.

## ACKNOWLEDGEMENT

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