# Collision of Sizing Agents on Wet End Fabric Performance And It's Life

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## ABSTRACT

A series of chemicals were employed to impart size - fiber bonds at various pH in wet end .The bonding strength have been proved to be dependent upon the type of bonding. In rosin alum size the size bond is indirect(through an aluminum co - ordinate complex ) , which is vulnerable to attack by acid , alkali and especially aluminum complex ligands, in which ligand substitutions take place .Alkyl Ketene Dimer (AKD) can react with cellulose to form direct β-Keto ester bonds. If a small amount of alum is used in AKD sizing under acidic conditions, the two types of bonds are formed. Paper machine clothing is a very important consumable high tech store on a paper or board machine since it plays a very vital role in quality and rate of production. In this research paper it was carried out to limelight the impact of using AKD and alum in wet end for sizing.


***Key word: AKD, Alum, Rosin, Binary Sizing, Picking, Couch lumps, Press lumps.***

## Introduction

The paper industry uses various sizing agents to give degree of resistance to wetting and penetration by aqueous liquids. There are two basic categories of sizing agents: acid and alkaline. Acid sizing agents are intended for use in acid papermaking systems, traditionally less than pH 5. Analogously, alkaline sizing agents are intended for use in alkaline papermaking systems, typically at a pH greater than 6.5 [1-2].

Most acid sizing agents are based on rosin; sizing agents for papermaking systems above pH 6.5 are generally based on alkyl ketene dimer (AKD) and alkenyl succinic anhydride (ASA). Rosin size under acid conditions has been the most widely used sizing agent since sizing technology was developed in 1807. Unfortunately, acidic sizing has several drawbacks, such as yellowing and embrittlement of paper, machine corrosion, and paper strength losses. In fact, many mills have shifted their papermaking conditions from acidic to the neutral-alkaline region to satisfy the requirements of higher strength and increased longevity of archival papers. It also allows mills to use calcium carbonate fillers in making printing paper. Binary sizing of paper was reported by Paul (3) for the better runability of paper machine.

## Scope of The Study

The present study has focused on the wet end breaks, cleaning frequency and wet end fabric changing time due to the application of binary sizing

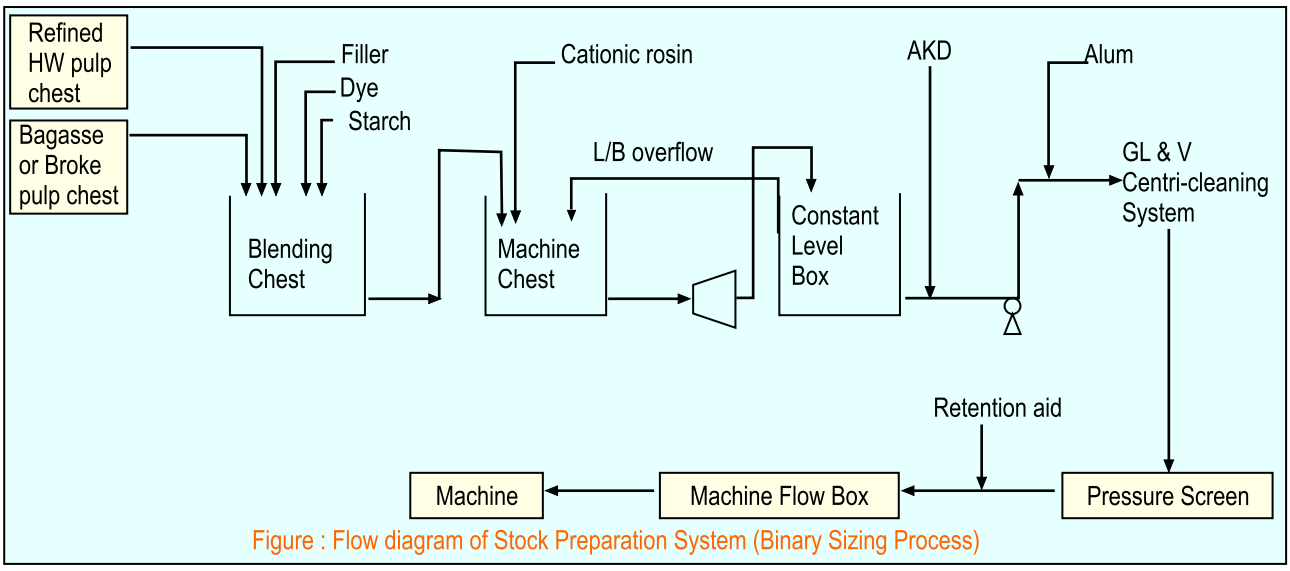


Figure : Flow diagram of Stock Preparation System (Binary Sizing Process)

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## Material and Methods

The plant trial was conducted in a secondary grade paper mill with the MF machine , operating speed of 160-200 mpm .The furnish was used for this study 20 % wood 30%waste paper and 40% imported wood pulp, 10% ash. All the sizing agents' quantity was carefully noted. The couch, press break were analyzed and the Felt surface cleanliness was studied .All other operating parameter was maintained as normal working conditions.

## Experimental

The addition point and chemical dosage were shown back page.

Table : 2

Break Analysis per day with Binary sizing

| Date | Couch Break | Press Break | % Ash | M/C Speed | Gsm |
|---|---|---|---|---|---|
| 15.9.2013 | 14 | 16 | 4.0 | 180 | 50 |
| 16.9.2013 | 18 | 14 | 5.0 | 170 | 52 |
| 17.9.2013 | 25 | 17 | 3.0 | 165 | 50 |
| 18.9.2013 | 17 | 18 | 5.0 | 165 | 54 |
| 19.9.2013 | 29 | 18 | 6.0 | 172 | 50 |
| 20.9.2013 | 19 | 17 | 3.0 | 179 | 54 |
| 21.9.2013 | 20 | 19 | 7.0 | 166 | 50 |
| 22.9.2013 | 19 | 17 | 5.0 | 165 | 52 |
| 23.9.2013 | 29 | 15 | 4.0 | 164 | 52 |
| 24.9.2013 | 18 | 18 | 6.0 | 170 | 52 |
| 25.9.2013 | 22 | 14 | 7.0 | 165 | 50 |
| 26.9.2013 | 6 | 5 | 2.0 | 185 | 54 |
| 27.9.2013 | 15 | 13 | 5.7 | 176 | 52 |
| 28.9.2013 | 20 | 13 | 4.0 | 179 | 55 |
| 29.9.2013 | 21 | 25 | 5.7 | 163 | 54 |
| 30.9.2013 | 16 | 14 | 7.5 | 160 | 52 |
| 1.10.2013 | 15 | 17 | 6.6 | 168 | 52 |
| 2.10.2013 | 12 | 18 | 7.1 | 165 | 50 |
| 3.10.2013 | 18 | 15 | 7.9 | 155 | 55 |
| 4.10.2013 | 15 | 14 | 4.9 | 170 | 54 |
| 5.10.2013 | 11 | 19 | 5.0 | 175 | 54 |
| 6.10.2013 | 18 | 15 | 4.8 | 164 | 50 |
| 7.10.2013 | 16 | 14 | 5.8 | 165 | 50 |
| 8.10.2013 | 19 | 8 | 6.0 | 176 | 50 |
| 9.10.2013 | 16 | 15 | 7.6 | 156 | 54 |
| 10.10.2013 | 19 | 11 | 6.3 | 176 | 52 |

## Result and Discussion

The binary sizing trial was carried as per the table: 1 with the Cationic Rosin, AKD, and Alum. From the table it is seen the addition

Chemicals used and its quantity.

Table : 1

| SL No. | Sizing Agents | Quantity |
|---|---|---|
| 1 | Cationic Rosin | 8 kg/ t o Pulp |
| 2 | AKD | 6 kg/t of Pulp |
| 3 | Alum | 6 kg/t of pulp |
| 4 | RA | 50 gm |

Table : 3

Break Analysis per day Alkaline sizing without Alum

| Date | Couch Break | Press Break | % Ash | M/C Speed | Gsm |
|---|---|---|---|---|---|
| 15.8.2013 | 6 | 2 | 9.0 | 188 | 50 |
| 16.8.2013 | 5 | 4 | 9.5 | 185 | 52 |
| 17.8.2013 | 3 | 4 | 8.9 | 182 | 50 |
| 18.8.2013 | 4 | 5 | 9.2 | 183 | 54 |
| 19.8.2013 | 2 | 5 | 9.8 | 181 | 50 |
| 20.8.2013 | 7 | 5 | 9.8 | 185 | 54 |
| 21.8.2013 | 2 | 3 | 10.0 | 182 | 50 |
| 22.8.2013 | 5 | 4 | 9.9 | 180 | 52 |
| 23.8.2013 | 6 | 3 | 9.8 | 184 | 52 |
| 24.8.2013 | 4 | 6 | 9.6 | 183 | 52 |
| 25.8.2013 | 6 | 3 | 9.7 | 183 | 50 |
| 26.8.2013 | 3 | 3 | 9.8 | 186 | 54 |
| 27.8.2013 | 7 | 6 | 9.7 | 183 | 52 |
| 28.8.2013 | 4 | 5 | 9.0 | 184 | 55 |
| 29.8.2013 | 7 | 4 | 9.4 | 182 | 54 |
| 30.8.2013 | 4 | 6 | 9.5 | 181 | 52 |
| 31.8.2013 | 6 | 4 | 9.3 | 180 | 52 |
| 1.9.2013 | 7 | 5 | 6.3 | 183 | 50 |
| 2.9.2013 | 3 | 2 | 9.5 | 185 | 54 |
| 3.9.2013 | 1 | 3 | 9.5 | 185 | 55 |
| 4.9.2013 | 4 | 7 | 9.6 | 180 | 54 |
| 5.9.2013 | 4 | 8 | 9.8 | 182 | 54 |
| 6.9.2013 | 4 | 4 | 9.9 | 184 | 50 |
| 7.9.2013 | 5 | 8 | 9.7 | 185 | 50 |
| 8.9.2013 | 6 | 4 | 9.5 | 182 | 50 |
| 9.9.2013 | 7 | 4 | 9.4 | 183 | 54 |
| 10.9.2013 | 5 | 4 | 9.5 | 184 | 52 |

of alum in binary sizing along with the AKD , reduces the machine speed and also hindered the addition ash .Size molecules are amphiphilic comprising a hydrophilic head and a hydrocarbon part, which gives the desired hydrophobic properties(4). The reaction mechanism can be explained as :

Aluminum oxide, or alumina, is listed as being insoluble in water, and only very slightly soluble in acid and alkali (5). In fact, the solubility of aluminum compounds in general is pH dependent. As Figure 1 indicates, aluminum can exist in at least five forms, depending upon pH(6) these five forms, the completely soluble form is the $Al^{3+}$ form that exists at a low pH (generally below pH = 4.5). Figure 2 examines just the lower pH portion of the curve, and indicates that the soluble fraction reaches its maximum at a pH below 4. Note that these curves may be shifted left or right depending upon changes in aluminum concentration, temperature, etc. (7).

Fig : 1

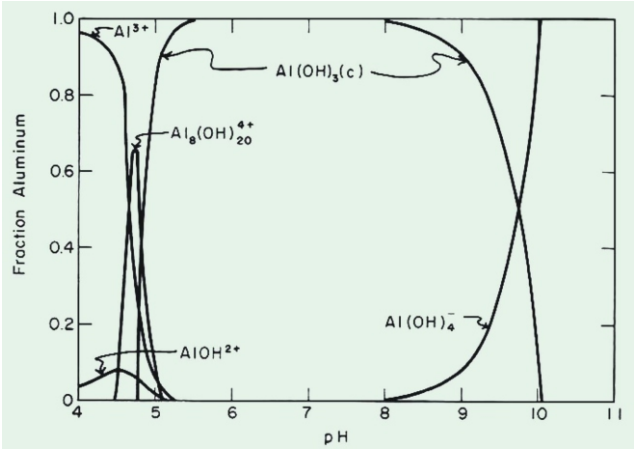
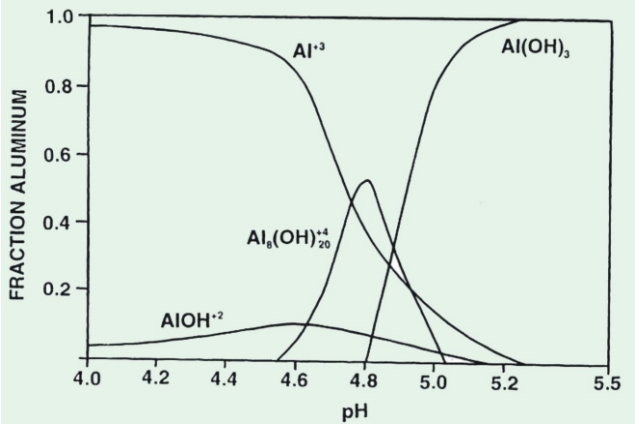



Fig : 2




The formation of $Al(OH)_3$ precipitate lowers the sizing efficiency and causes the sticky colloidal matters on wire and felt .

## Efect on Wire and Felt

Fig : 3

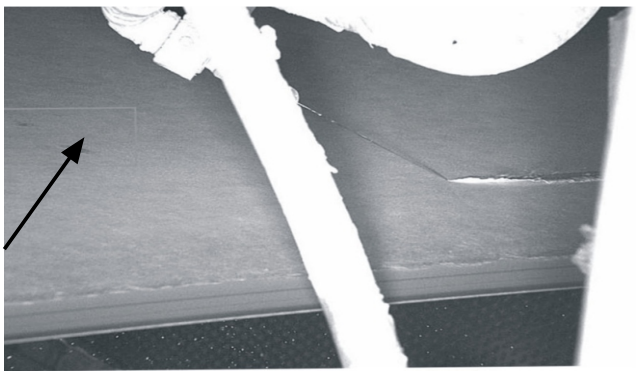
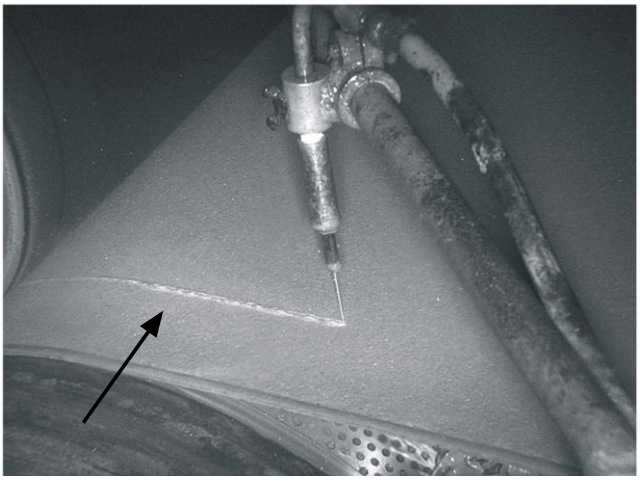


Fig : 4



The arrow mark shows the deposit on wire caused by the $Al(OH)_3$ precipitate which causes the couch break by pick up to press and inefficient edge trim by Squirt.

Fig : 5

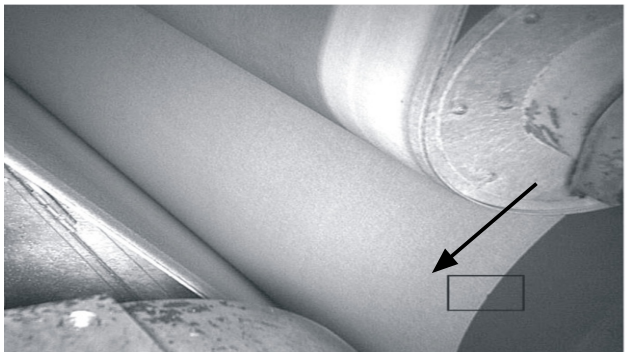


Fig : 6

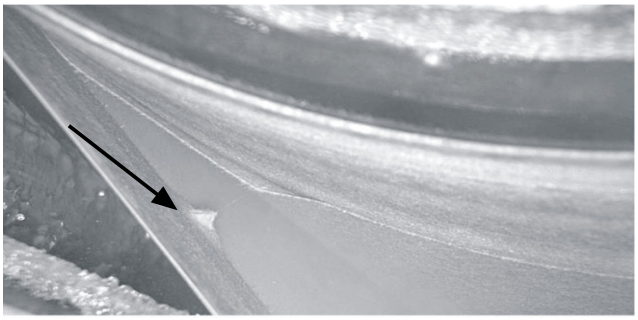
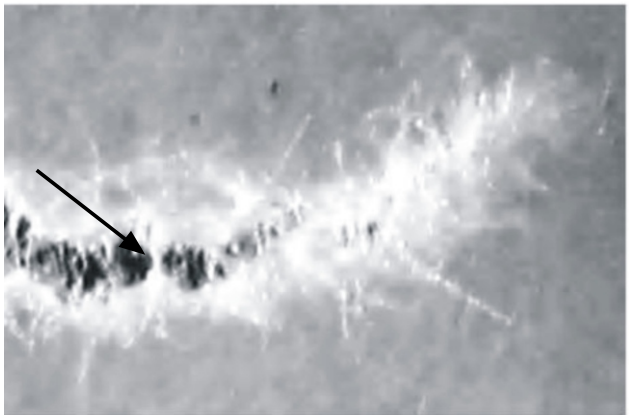


Fig : 7



It can be seen from the fig No,5, 6,7 the $Al(OH)_3$ precipitate causes edge flip , pick up roll damage , felt surface damage due to frequent cleaning by chemicals and adjusting the cleaning nozzle / shower pressure

## Conclusions

From the above plant trial it can be seen Binary sizing reduces the machine runnability . During this trial it has observed that lot of couch / press breaks due to the hydrolysed product of Al $(OH)_3$ precipitate. Alum with AKD sizing not only affects the machine runnability but also affects the wire and felt leads to poor drying and high steam consumption. The addition of alum along with AKD yields adverse effect for Wet end fabrics which should be eliminated in alkaline sizing. It has been found that the application alum in ASA system only for the coagulation purpose of poor water .Many authors have applied this concept to AKD sizing .But it was not appreciated with respect to wet end performance and health report of wet end fabrics.

To get maximum efficiency from wet end fabrics the additives entering into the paper machine / wet end have been taken into the account.

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