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Roll Of Sizing In Printing Paper

Annu Rani
Department of Printing Technology GJUS&T, Hisar (Haryana)
E-mail- saiannu30@gmail.com

Abstract
Sizing is used in papermaking and textile manufacturing to change the absorption and wear characteristics of those materials; it is the term used for oil-based surface preparation for gilding and it is used by painters and artists to prepare paper and textile surfaces for some art techniques. This document gives information about water resistant property of paper i.e. sizing. It gives details of sizing materials and requirement of properties for different printing methods.
Keywords*: Sizing, Preservation, gilding.*

1-INTRODUCTION

It is considered that printing; has fostered communication and propagated the knowledge, has done more to develop civilization. It has been so only because of use of paper. The forerunner of paper (c. 2600 BC) was papyrus, a material made out of the papyrus plant, which grows in Africa. The actual invention of paper produced from plant fibers such as bamboo fibres or cambric grass dates back to about AD 105; recent literature refers to paper production actually dating much further back. Tsai Lun from China is accredited as the inventor. Now a day it is widely used. But different printing methods require different properties of paper. One of such important property is sizing.

Sizing is used during paper manufacture to reduce the paper's tendency when dry to absorb liquid, with the goal of allowing inks and paints to remain on the surface of the paper and to dry there, rather than be absorbed into the paper. This provides a more consistent, economical, and precise printing, painting, and writing surface. This is achieved by curbing the paper fibers' tendency to absorb liquids by capillary action. In addition, sizing affects abrasiveness, creasibility, finish, printability, smoothness, and surface bond strength and decreases surface porosity.

2- ROLL OF SIZING

Sizing refers to imparting some degree of resistance to the absorption or penetration of liquids, especially water. Sizing of paper is a very old and well-established art and a wide variety of materials have been sized. As is well known, the sizing agent may be applied to the fibres during the papermaking operation, in which case the process is called internal sizing (also known as beater sizing or engine sizing), or it may be applied to the surface of the paper after web formation, in which case it is called external or surface sizing.

Most of the end-use properties that the size includes one or several of the following:

- Increased Hydrophobic;
- Film-Formation or Barrier Properties;
- Increased Surface Strength;
- Modified Frictional Properties;
- Modified Optical Properties;
- Reduced Sheet Porosity.

3-TYPES OF SIZING

1. Internal Sizing- Internal sizing chemicals used in papermaking at the wet end are alkyl succinic anhydride (ASA), alkyl ketene dimer (AKD) and rosin. By making the

paper web more hydrophobic, the sizing agents influence dewatering and retention of fillers and fibers in the paper sheet. Next to paper quality, internal sizing agents' main effect is on run ability of the paper machine. A particularly important class of sizing agents for internal sizing are the fatty acid sizing agents, i.e. sodium, potassium or ammonium salts of long-chain saturated fatty acids. In employing these agents, it is conventional practice to add the sizing agent to the paper furnish and thereafter add a precipitating agent which aids in setting the size of the papermaking fibres. The precipitating agents used are water-soluble polyvalent metal salts, such as alum or aluminum chloride. Use of the aforesaid combination of sizing agent and precipitating agent can be accomplished in conventional papermaking machines without the aid of any special apparatus. Moreover, the materials used are of low cost and are generally quite effective in imparting to paper the ability to resist penetration by liquids. However, there are certain significant limitations and disadvantages associated with their use i.e. accumulation of the sizing agent at the press rolls of the papermaking machine or with clogging of pipes or other equipment by the sizing agent.

$Al_2(SO_4)_3 + 6H_2O = 2Al(OH)_3 + 3H_2SO_4$

2. External sizing / surface sizing- Applied to surface sizing this implies that the resistance is achieved by applying chemicals to the surface of the paper or board after it has been formed rather than adding chemicals to the wet pulp. Surface sizing solutions consists of mainly modified starches and sometimes other hydrocolloids, such as gelatin, or surface sizing agents such as acrylic co-polymers. Surface sizing agents are amphiphilic molecules, having both hydrophilic (water-loving) and hydrophobic (water-repelling) ends. The sizing agent adheres to substrate fibers and forms a film, with the hydrophilic tail facing the fiber and the hydrophobic tail facing outwards, resulting in a smooth finish that tends to be water-repellent. Sizing improves the surface strength, printability, and water resistance of the paper or material to which it is applied. In the sizing solution, optical brightening agents (OBA) may also be added to improve the opacity and whiteness of the paper or material surface. In modern technology, surface sizing also involves conferring properties besides hydrophobicity. Parameters loosely referred to as printability, gullibility and run ability may also be important in some applications. A better expression than surface size in these circumstances is surface modifier or surface enhancer. There has been a drive towards higher specification paper grades. In some cases the paper properties required would be difficult or impossible to achieve without application of chemicals at the surface. Increased production of coated grades has also encouraged surface sizing which is used to control coating hold-out.

Increased emphasis on environmental issues and the need to clean up the 'wet-end' system have also promoted modern surface sizing. A cleaner wet end allows better control of the papermaking process and makes substantial financial savings possible on large, fast machines. The risk of penalties charged on high levels of chemical oxygen demand (COD) in the mill effluent can provide a strong incentive to increase the amount of chemical treatment at the paper surface where retention of chemicals applied is essentially 100%.

The formulation applied at the size press will usually consist of a mixture of chemicals. These can be classified according to their function:

- Transport medium;
- Surface strengthening agents;
- Specialty chemicals;
- Surface sizes or hydrophobing agents.

Starch - This is the most abundant material present in the formulation, and the starch solution acts as the transport medium or carrier for the surface size. Nevertheless, it should be stressed that the type, viscosity,

temperature, and pH of the starch can all affect the amount of surface size applied, where it ends up in the sheet, and how it performs. The main sources of starch are potato (farina), maize (corn), wheat, and tapioca derived from cassava, which is an important source in hotter regions of the world. The starch is usually a by-product and so its price and purity depend on many factors such as agricultural policy and extraction process. Recently in Europe there has been a reduction in the availability of potato starch and so maize starch is most commonly used. However, wheat starch often offers a cheaper alternative but contains some protein impurities (residual gluten) which can affect foaming properties and viscosity control. Before it can be used at the size press the native or pearl starch must be converted to modify the viscosity properties of the starch solution. The starch may be reconverted by the starch supplier but most mills prefer to make their own conversion to save costs. The conversion involves breaking bonds in the large starch molecule and can be done by an enzyme, thermo mechanical or thermo chemical process. The conversion may be a continuous or batch process and selection will depend on cost, viscosity, and solids content requirements. Whatever starch and conversion process is chosen it is important to maintain consistent size-press starch solution properties for efficient application of surface size. The starches may also be modified chemically by reacting with other chemical groups onto the converted starch molecule. The most common derivative starches are ethylated, acetylated, oxidized or have cationic groups added. Acetylated starches give particularly good film- formation properties to the starch. The advantage of cationic starches is that they form ionic bonds with the anionic fibers and fillers and so remain with the fiber during repulsing. This has been reported to result in at least a 50% reduction in biological oxygen demand (BOD). Chemical treatment of the starch increases its cost and so use of chemically-modified starches must usually be justified by giving added value to the paper, improving paper machine run ability or reducing effluent loadings in the backwater. Although starch is by far the most common additive at the size press, surface size can be applied without starch or with an alternative co-agent, such as polyvinyl alcohol, sodium alginates, or carboxy-methyl cellulose. These materials are chosen for their good film- forming properties which bond together fibers at the surface and fill holes in the paper structure. Another important property is their viscosity-modifying effect which influences the pick-up of the size-press mixture. The surface size can also be applied as part of a coating mix which then effectively becomes the carrier. This may be a convenient way to add the size in cases where there is no separate size press available provided the surface size is compatible with the coating mix, but generally the size is less effective when used in this way because it tends to be within the coating layer and less available for influencing the surface properties. Specialty chemicals can consist of a wide range of chemicals for specific end-use applications. Typically they include materials such as dyes, fluorescent brightening agents (FBAs) and security chemicals.

4- PRESERVATION OF PAPER

While sizing is intended to make paper more suitable for printing, it also makes printing paper less durable and poses a problem for preservation of printed documents. Hunter describes the process of sizing in these paper mills in the following:

“The drying completed, the old papermakers dipped their paper into an animal size that had been made from the parings of hides, which they procured from the parchment-makers. It was necessary to size that paper so that it would be impervious to ink, but sizing was more needed in writing than in printing papers. Many books of the fifteenth century were printed upon paper that had not been sized, this extra treatment not being essential for a type impression. The sizing

was accomplished by a worker holding a number of sheets by the aid of two wooden sticks, and dipping the paper into the warm gelatinous liquid. The sheets were then pressed to extract the superfluous gelatine. This crude method of sizing the paper was extremely wasteful as many sheets were torn and bruised beyond use. The sizing room of the early paper mills was, for this reason, known as the 'slaughter-house'.

With the advent of the mass production of paper, the type of size used for paper production also changed. As Swartzburg writes, "By 1850 rosin size had come into use. Unfortunately, it produces a chemical action that hastens the decomposition of even the finest papers." In the field of library preservation it is known "that acid hydrolysis of cellulose and related carbo-hydrates is one of the key factors responsible for the degradation of paper during ageing." Some recent professional work has focused on the specific in the degradation involved in the deterioration of paper that has had a rosin sizing process, and what amount of rosin affects the deterioration process, in addition to work on developing permanent paper and sizing agents that will not eventually destroy the paper. An issue on the periphery to the preservation of paper and sizing, is washing, which is described by V. Daniels and J. Kosek as, "The removal of discoloration in water is principally effected by the dissolution of water-soluble material; this is usually done by immersing paper in water." In such a process, surface level items applied to the paper, such as size in early paper making processes as seen above, have the possibility of being removed from the paper, which might have some item specific interest in a special collections library. With later processes in paper making being more akin to "engine sizing," as H. Hardman and E. J. Cole describe it, "Engine sizing, which is part of the manufacturing process, has the ingredients added to the furnish or stock prior to sheet formation," the concern for the removal of size is less, and as such, most literature focuses on the more pressing issue of preserving acidic papers and similar issues.

5- CONCLUSION

Sizing is used during paper manufacture to reduce the paper's tendency when dry to absorb liquid, with the goal of allowing inks and paints to remain on the surface of the paper and to dry there, rather than be absorbed into the paper. Sizing makes paper more hydrophobic; reduce porosity of paper and increase fuctional and optical properties of paper. Along with increase in surface smoothness and hydrophobic properties, sizing reduces the strength of paper so it requires more preservation.

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