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CRITICAL ANALYSIS OF OFFSET FOUNTAIN SOLUTION CONSTITUENTS

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ABSTRACT

The publishing and printing industry is evolving under the influence of scientific and technological progress. The driving force are the specialized production and personalized products based on modern digital technology, enhancing continuity and flexibility, automation and computerization of publishing and printing systems, the introduction of new digital monitoring and support properties, materials, constant improvement of quality requirements for finished products and so on. Offset printing with printing plates dampening holds a leading position in the production of printing products and is experiencing now all forms of scientific progress. The performance and print quality of offset printing with printing plates dampening depend on many factors, and quality of various printing and packaging products, in its turn, in the current environment requires the least aggressive environmental impact. The most important factors of the printing process are: printing material properties, process conditions and their interaction.

I. INTRODUCTION

Changes in the properties of the components of the technological environment, ignoring of printing parameters can lead to: unstable process ,color reproduction infringement, various defects etc. An important component of offset printing is dampening fluid which should be thoroughly monitored daily Whereas the constant sharpening of the quality requirements to the printing and packaging products, an urgent task for the further improvement and development of environmentally friendly offset printing with printing plates. We need to regular development in fount solution.

Lithography works on the principle that oil and water do not mix with each other. The image areas on the printing surface i.e. plate must be oleophilic as well as hydrophobic. At the same time, the non image areas on the plate must be oleophobic& hydrophilic. On the press, during printing the operator strives to achieve optimum ink-water balance. Ideally the ink should have about 15% water accepting capacity i.e. water in ink emulsification. The fountain solution keeps the non image areas on the plate hydrophilic as well as oleophobic. Its ingredients other than water also perform various functions. The ingredient such as isopropyl alcohol also poses environmental problems; hence it has to be dealt very carefully.

II. ROLE OF THE FOUNTAIN SOLUTION

The role of the offset printing fountain solution is:

(a) To keep the non-image area of the plate free of ink,
(b) To maintain a wide latitude of water balance in the ink train,
(c) To provide uniform and even fountain solution feed,
(d) To provide good stability for pH and conductivity control,
(e) To have little or no effect on ink drying time,
(f) To provide foam control,
(g) To control ink roll stripping,
(h) To balance emulsification of the ink,
(i) To have the proper effect on ink rheology,
(j) To control the ink/fountain solution surface tension between 35 and 40 dynes/cm

III. INGREDIENTS USED IN FOUNTAIN SOLUTION

The following are the major ingredients used in fountain solutions along with water:

(a) Water soluble gums.
(b) A PH buffer system.
(c) Desensitizing salts.
(d) Acids or their salts.
(e) Wetting agents
(f) Solvents.
(g) Non-piling or lubricating additives.
(h) Emulsion control agents.
(i) Viscosity builders.
(j) Biocides.
(k) Deformers.
(l) Dyes.

IV. PURPOSE OF USING ALCOHOL

(a) Alcohol is a very good wetting agent, it improves dampening flow.
(b) Alcohol evaporates from the ink rollers quickly, leaving no residue.
(c) The evaporation helps cool the ink train.
(d) The viscosity of water & thus of fountain solution increases as IPA is added (up to about 25% alcohol concentration by volume).
(e) Alcohol is used at high percentages compared to other fountain ingredients.
(f) Alcohol gives only medium surface tension, but, because the molecules are small, its dynamic properties are exceptionally good. It gives very fast surface tension reduction.

V. MAJOR VARIABLES TO BE MONITORED IN FOUNTAIN SOLUTION

Following are some variables which need to be monitored for optimum performance of fountain solution.

Water Hardness

Water is the most important ingredient of fountain solution and it is the ingredient present in highest percentage. A printer uses tap water as the source material for the fountain solution. This water found in nature is not clean; rather it contains numerous gasses and minerals. If the proportions of these salts are exceeding certain tolerance, the fountain solution ingredients may have to be modified to achieve desired results. The hardness of the water must be calculated before any additives are introduced, since hardness is no longer easily determined in a prepared dampening solution. Test-strips are useful in performing a simple determination of the total water hardness. The proportion of lime in the water can cause the following problems during printing

(a) The inking rollers run blank (calcification)
(b) Deposits on the rubber blanket
(c) Impact on the pH-Balance
(d) Fluctuation in the pH-Balance
(e) If the proportion of chloride, sulphate, or nitrate is too high, it will lead to corrosion.

Conductivity

It describes how electricity is conducted through a liquid; impurities in the dampening solution allow conductivity to increase. Conductivity varies depending on the water and additives. The temperature and the concentration of alcohol also influence conductivity. By increasing Iso Propyl Alcohol (IPA), conductivity declines. Conductivity should be determined using a “freshly prepared dampening solution”, so that this measure can then serve as a standard when the dampening solution is later exchanged. When the conductivity in the dampening solution has climbed by approx. 1000 µS/cm, this should be taken as a signal that it is time to change the dampening solution.

PH

Ideally, the dampening solution should possess a pH-Balance of 4.8 to 5.5. Higher pH readings may cause scumming and toning, whereas pH readings of less than 4.0 may retard or inactivate ink drying by locking up the catalytic dryers in the ink. Buffers are chemicals that are used in fountain concentrates to help stabilize the pH level of the mixed solution. Buffers reduce the tendency of pH to drift (becoming more acidic or alkaline)

due to the introduction of contaminants such as paper coatings, inks, wash-up solutions, and any other contaminant. Fountain solutions are buffered to maintain low pH because the gums used to desensitize and protect the plate non-image area lose effectiveness as pH rises. Fountain solution additives are buffered, in order for the most part to neutralize external influences. A pH-Balance measure does not tell about the quality of the dampening solution it only shows, whether an additive is present or not. In order to decide the quality of the dampening solution, its conductivity should also be determined.

Acidic buffer solutions (pH less than 7) weak acid and one of its salts e.g. acetic acid and Sodium acetate in solution.Alkaline buffer solutions (pH greater than 7).Weak base and one of its salts e.g. ammonia solution & ammonium chloride solution. If these were mixed in equal molar proportions, the pH would be 9.25.

Emulsifiers

A stable emulsion consisting of two pure liquids cannot be prepared; to achieve stability, a third component, an emulsifying agent must be present. Generally, the introduction of an emulsifying agent will lower the interfacial tension of the two phases. A large number of emulsifying agents are known; they can be classified broadly into several groups. The largest group is that of the soaps, detergents, and other compounds whose basic structure is a paraffin chain terminating in a polar group.

Surface Tension

Surface tension is an effect within the surface layer of a liquid that causes the layer to behave as an elastic sheet. It is the effect that allows insects (such as the water strider) to walk on water, and causes capillary action. Surface tension is caused by the attraction between the molecules of the liquid, due to various intermolecular forces. In the bulk of the liquid each molecule is pulled equally in all directions by neighboring liquid molecules, resulting in a net force of zero. At the surface of the liquid, the molecules are pulled inwards by other molecules deeper inside the liquid, but there are no liquid molecules on the outside to balance these forces. (There may also be a small outward attraction caused by air molecules, but as air is much less dense than the liquid, this force is negligible.) All of the molecules at the surface are therefore subject to an inward force of molecular attraction which can be balanced only by the resistance of the liquid to compression. Thus the liquid squeezes itself together until it has the locally lowest surface area possible. Surface tension, measured in Newton's per meter (N/m), is represented by the symbol γ and is defined as the force along a line of unit length perpendicular to the surface, or work done per unit area. The surface tension of ideal fountain solution is about 34 dynes / cm.

VI. TYPES OF FOUNTAIN SOLUTION

(a) Acidic Fountain Solution
(b) Neutral Fountain Solution
(c) Basic Fountain Solution

Acidic Fountain Solution

The acid fountain solution normally consists of:

(a) A desensitizing gum (gum Arabic or others)
(b) A desensitizing acid (phosphoric, phosphate, citric or lactic acid)
(c) A buffer such as magnesium nitrate
(d) Alcohol substitutes (glycol ether families)
(e) Fungicides.

The pH range is normally between 4.0 and 5.5.

Neutral Fount Solution

Neutral fountain solutions contain salts of weak acids and bases such as phosphates, phthalates, tart rates and citrates. They can also contain wetting agents and they normally function in the pH range from 5.5 to 7.5.

Alkaline Fountain Solution

The alkaline fountain solution contains either sodium carbonate, sodium silicate, or a sequestering agent, which keeps the calcium and magnesium compounds from precipitating and various surface active agents. The pH range is normally controlled between 8.0 and 10.

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Sheet-Fed & Web-Fed Fount Solution

Sheet-fed fountain solution

Sheet-fed fountain solution is used in the sheet fed offset machines. The main ingredients are same as the use in web fed fount solution depending upon the nature of the fount.
Basically Sheet-fed fount solution of two types:

Water based dampening sheet-fed solution

In this type of fount we don't required to mix IPA during making fountain solution. This type of fount solution is only used for those machines which are designed for it. These types of machine having very less speed as compared to the Alco-dampening.

Alco based dampening sheet-fed solution

In these types of fount solution we have to add 7 to 10 % of IPA for making the fount solution. These types of fount solution are used for the high speed machines. This fount solution is providing higher quality and very good ink and water balance during printing.

Web Fed Fountain Solution

It's same as fount Solution used in sheet fed offset but the difference in the conductivity and the percentage of the ingredients used for making the fount solution. Web fed fount solution is also depending upon the dampening systems used in the web fed machine. They may be acidic, basic or neutral depending upon the nature of the fount.

VII. RESEARCH OBJECTIVE

The Objective of this study is to collect the information of the consumption of fount solution on different - different machines and minimizing the consumption of fount solution.

(a) To improve the quality of fount solution.
(b) To reduced the percentage of fount solution.
(c) Minimized the consumption of fount solution in sheet fed and web fed printing.
(d) Impact of alcohol free fount solution over the printing.
(e) Making the printing free of IPA.
(f) Providing the complete detail of web fed and sheet fed fount.

VIII. RESEARCH METHODOLOGY

The whole Study includes the complete detail of fount solution and its behavior on sheet-fed & web-fed. The following methodology will be adopted during the study;

(a) Study of different-different fount solution used in sheet-fed & web-fed.
(b) Study of wastage reduction techniques in fountain solution during Printing.
(c) Arrange the trial of web fount and checking the exact consumption of fount and changes in parameters (PH, Conductivity) with respect to printing .At different – different presses during my training period in "**KAPOOR IMAGING PVT LTD".**
(d) Arrange the trial of sheet fed fount and study the consumption of fount and also study about the parameters changes during printing.
(e) Also arrange the trials of IPA Free fount and checking the difference between the founts.

IX. FUTURE & SCOPE

This research focuses on to the quality management & waste reduction during printing in different -different presses during the Trials. In all these methodologies, when check list gets adopted number of wastage depending upon the chiller and machine availability. This preliminary result can be used and in future check point suggestions incorporated in the printing section may be indicative for other organizations. They may be modify, Increase or decrease. The factors to be Considered .To implement the suggestions properly we generate a check list in form of table to check the different factors before all the trials to be handled on the different different machines .And check point helps to reduce the wastage of fount, paper & board with proper quality control .The study may be concluded in a manner that, If all suggestion were implemented for reducing wastage & improving quality will implemented then a positive result will achieved.

It also helps us to develop a batter fount which having combine specification of sheet-fed and web-fed fount.
It also helps us to minimize the cost of the fount solution.

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