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INFLUENCE OF FOUNTAIN SOLUTION CONDUCTIVITY ON PRINT QUALITY IN OFFSET PRINTING

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ABSTRACT

Print quality is the most exclusively evaluated term in printing. In recent times print quality has been assumed of greater significance across the globe. Offset printing is known for its quality aspects and versatility. It is a complex process where many parameters including fountain solution properties greatly influence the quality of the final print run. From a technological perspective, it needs to analyse the variation in print quality due to conductivity of fountain solution while printing by offset machine. In this paper, an attempt is made to analyse the influence of change in conductivity of fountain solution on print quality on coated and uncoated paper.

Keywords: Fountain solution, Conductivity, Offset Printing, Print quality, Paper.

INTRODUCTION

Offset printing based on the principle is that ink and water do not mix with each other. Both the surfaces are separated chemically by use of the natural principle, "Water repels grease and grease repels water." (Encyclopaedia, 2013; Deshpande, 2011).

Ink and water balance fluctuations invites a lot of printing problems. Offset presses uses the metal printing plates with a fountain solution, which function is to desensitize the non-image areas and by making them ink-repellent. (Smithsonian, 2012; Deshpande, M.S, 2011).

In addition to water, dampening solution generally contains following ingredients; an acid aid gum to bond a plate, gum to desensitize the non-image area of plate, a wetting agent and surfactants for lowering surface tension, a corrosion inhibitor which avoid oxidation or other chemical reactions which may spoil the plate, salts for protecting and renew a plate surface, buffer for maintaining constant pH, biocide or fungicide which helps killing any organic growth, antifoaming agent help to stop the increase of foam.

Conductivity: - A solution skill to pass on an electrical charge. The measurement of the number of ions in a solution is needed for measuring conductivity. The higher the conductivity degree is resulted by the higher ion concentration. Pure water is a poor conductor of electricity if it approaches zero micromhos conductivity. The conductivity of water is directly proportional to the amount of undissolved solids like potassium or sodium in it. Abnormal change in the conductivity of fountain solution may be caused by impurity from some cause e.g. ink particles, paper filler and fibers etc. So conductivity increases when impurities in the dampening solution are increased. (Mahajan, 2006; PIA/GATF, 2007; Sappi Europe SA, 2004).

Function of Fountain Solution: - Maintain pH value resulting that image area is ink accessible and non-image area is water accessible, extends the life of plate by minimizing corrosive action of acids on plate, protecting non-image area from accepting ink, and also maintains the wetting characteristics by lowering surface tension. (Dynodan, 2012; Froberg et al, 2000; Fuchs, 1996).

RESEARCH METHODOLOGY

The input objectives of this research are to delineate the next aspect of print quality in Offset Printing: - to examine effect of conductivity on Dot Gain, to analyse effect of conductivity on Hue Error and Greyness, to analyse effect of conductivity on Slur and Scumming**.**

In order to carry out the research work, first of all a suitable master was prepared. This master was designed with great care and attention so that successful research can be done for effective results. The design of master was such that in which the value of density and other values can be measured easily in an effective way. In order to find effective results, the following image elements were included in the test for: - Line drawing in black colour.

A four colour pixel image with 145 LPI resolutions. Text matters from 6 point to 36 point to obtain the print quality in all the ranges of black colour. Grayscale patch from 0%, 3%, 5%, 10%, 15%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 95% and 100%. Colour control patch with Solid Ink Density, Dot in 25%, 50%, 75% and 100%. Registration marks in order to control better registration in four unlike positions i.e. left, right, top and bottom of the test form.

The plates were prepared by using CTP (Computer to Plate) system. Technova positive working PS (pre-sensitized) plates were taken for preparing plates, the reason being these plates are known for their excellent results. Also proper care was taken while handling and storing the plate before, during and after printing for research work. The printing work was carried out in Sheet-fed Offset Lab., Department of Printing Technology GJU S&T Hisar. The pressroom conditions in Sheet-fed Offset Press were accurate and strictly according to the printing parameters. Then printing was done on coated and uncoated paper. Then different print quality parameters were measured with the help of a spectrophotometer. Some viewing properties were observed by standard observers. The data so collected was recorded for analysis done with the help of suitable statistical and quantitative methods.

DATA COLLECTION AND ANALYSIS

Conductivity meter was used for measuring the conductivity of fountain solution used during press run. Data was collected by spectrodensitometer and viewing properties were denoted on the bases of their quality printed on to the substrate. And this quality was denoted by a particular grade. For research purposes fountain solution composition was divided into seven groups. The composition of seven groups is tabulated as: -

Table 1: Fountain solution composition seven groups (A to G)

Group Composition	A	B	C	D	E	F	G
Distilled water	1000 ml	950 ml	900 ml	850 ml	800 ml	750 ml	700 ml
Fountain Solution	0 ml	50 ml	100 ml	150 ml	200 ml	250 ml	300 ml
Conductivity	1.64 ms	3.15 ms	5.45 ms	7.70 ms	9.83 ms	11.72 ms	13.4 ms

The data was composed during research. The data so composed was compiled and analysed in order to achieve the research efficiently. By using this arithmetical data, the interpret results were uttered in graph and figure. The subsequent aspect was taken into deliberation during examination - to analyse effect of conductivity on Dot Gain, to analyse effect of conductivity on Hue Error and Greyness, to analyse effect of conductivity on Slur and Scumming.

These different aspects from research point of vision are elucidated as under: -

1. **To analyse effect of conductivity on Dot Gain: -** The result of conductivity on dot gain on coated and uncoated paper through the research are depicted in figure 1. It was found that the most values of dot gain on coated and uncoated paper were 9.09% and 21.37% respectively. The figure 1 is expressing the behaviour of dot gain as conductivity increases from group A to group G.

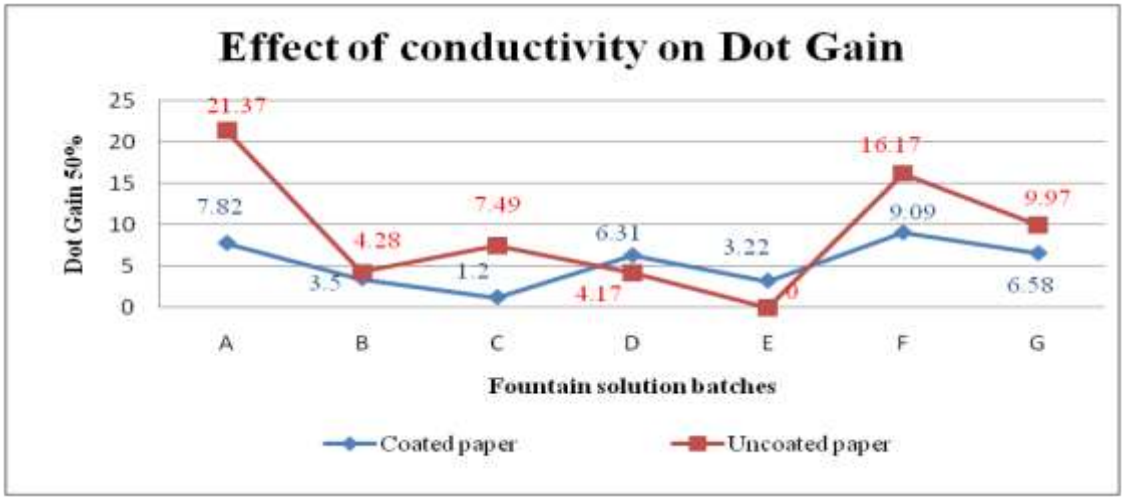

Fig. 1: - Effect of conductivity on Dot Gain on coated and uncoated paper

2. **To analyse effect of conductivity on Hue Error and Greyness: -** The effect of conductivity on Hue Error and Greyness on coated and uncoated paper during the research are depicted in fig.2 and fig. 3 respectively. The results indicate that the minimum value of Hue error on coated paper and uncoated paper was 4.3 and 4.2 respectively as present in fig. 2. While the maximum

value of Hue Error was recorded 6.8 and 5 on coated and uncoated papers respectively due to increase in conductivity from group A to group G.

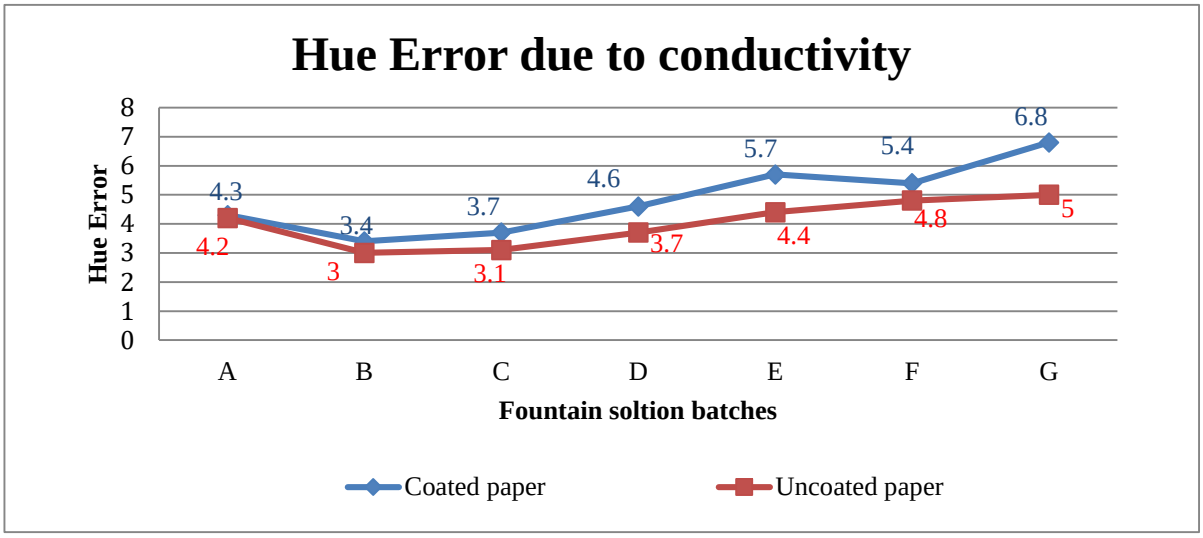

Fig. 2: - Effect of conductivity on Hue Error on coated and uncoated paper

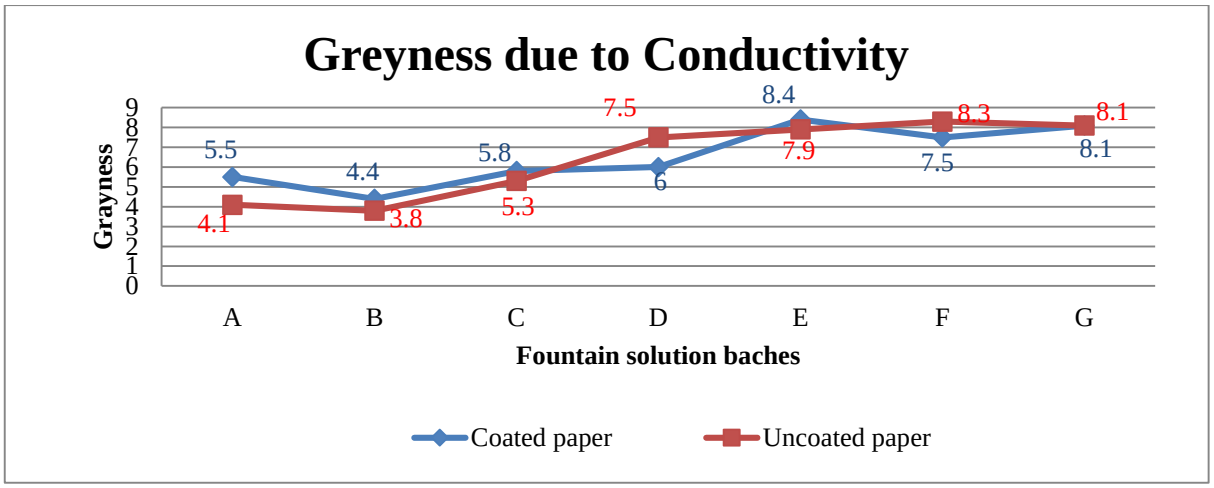

Fig. 3: - Effect of conductivity on Greyness on coated and uncoated paper

The data uttered in fig. 3 depicts that investigation results of Greyness due to the variation of conductivity of fountain solution. The maximum value of greyness was found 8.4 for coated paper at point E and 8.1 for uncoated paper at point G. While minimum value of greyness was recorded 4.4 for coated paper and 3.8 for uncoated paper. The figure 3 elucidates that increasing conductivity results in increasing greyness during printing.

3. **To analyse effect of conductivity on Slur and Scumming: -** The results of the present study of Slur and Scumming on coated and uncoated paper due to the effect of conductivity are depicted in fig. 4 and fig. 5 respectively.

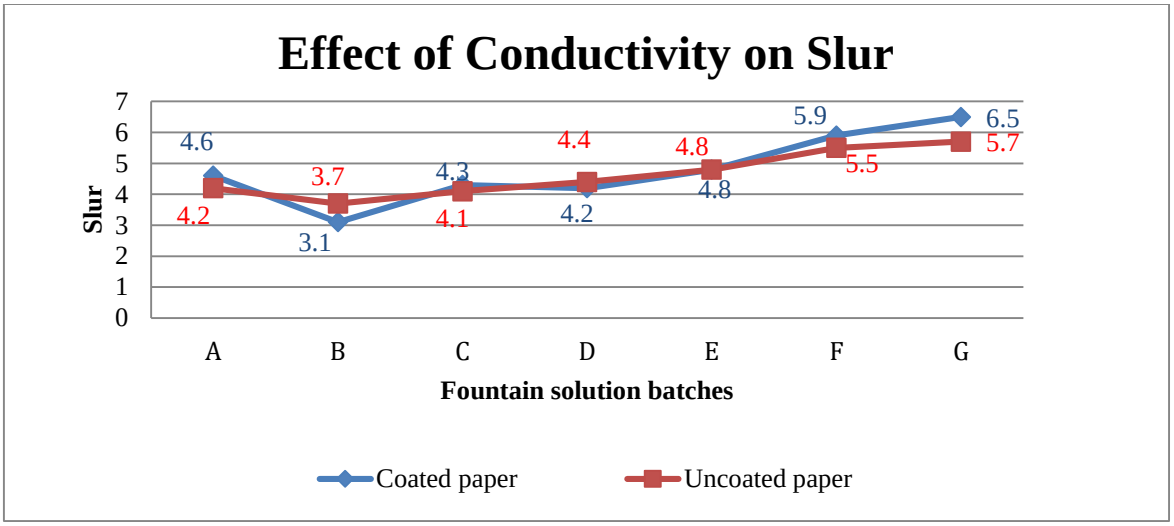

Fig. 4: - Effect of conductivity on Slur on coated and uncoated paper

The result of the observations of effect of conductivity on slur is presented in fig. 4 which depicts that maximum frequency of slurring is 6.5 and 5.7 on coated and uncoated paper respectively in group G where there was maximum conductivity. On the other hand, minimum values recorded on coated and uncoated paper were 3.1 and 3.7 respectively.

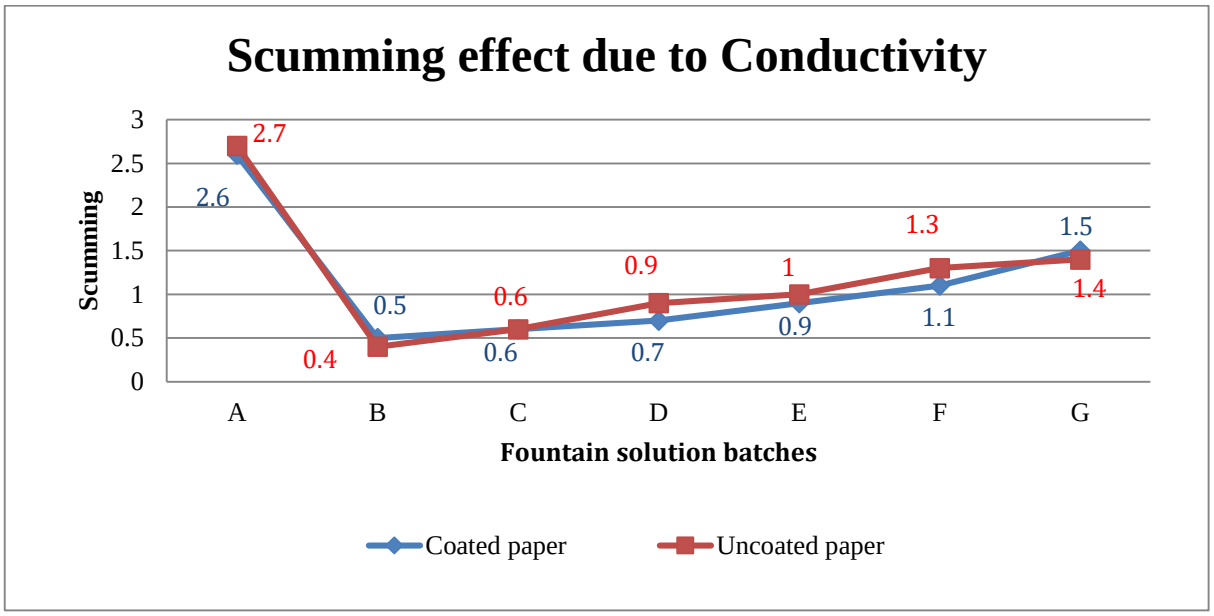

Fig. 5: - Effect of conductivity on Scumming on coated and uncoated paper

During the research, the results obtained for variation in scumming due to the increase in conductivity are depicted in fig. 5. We analysed that in group The frequency of scumming on coated and uncoated paper was respectively 2.6 and 2.7. Analysis from the A to B group indicates that there was steeper change in the frequency of scumming. It was recorded as 0.5 and 0.4 for coated and uncoated paper respectively. While in the G series of conductivity composition respective values of coated and uncoated paper were recorded 1.5 and 1.4. During investigation it was concluded that as conductivity was increased scumming frequency also increases on the bases of data analysed.

RESULTS AND DISCUSSION

After collecting the data, it was examined. It was experimental that the results obtained through the research were in harmony with the criterion range of print quality. Through the examination it was found that the characteristics of fountain solution play a vital role in offset printing. This is of prime significance. It is inevitable to maintain the fountain solution concentration in order to have better print results in terms of quality i.e. free from the defects. During the research the results obtained as delineated as: -

1. The Dot Gain was found more on uncoated paper compared to that of coated paper because uncoated paper absorbs more ink than coated paper and results in more dot gain.
2. The Dot Gain larger value was observed in group A.
3. Hue error was recorded more on coated paper. In the group “G” hue error was recorded more for both coated and uncoated paper.

4. In case of greyness more effect was recorded on coated paper in series E. on the other hand maximum effect on uncoated paper was observed in G series of conductivity of fountain solution.
5. Slur is more in case of coated paper because the ink can act as a lubricant and permit the slippage where there is enough ink coverage and on the uncoated paper the surface is usually rough to prevent slippage.
6. Scumming effect was observed more in A series for both coated and uncoated paper.

CONCLUSION

This research paper has obtained a concise indication of conductivity influence on print quality on coated and uncoated paper in offset printing with reference parameters of print quality. This paper elucidates how variations in conductivity respond to different print quality parameters. The fountain solution conductivity and pH both are essential parameters which decide the performance of dampening solution during press run. Conductivity acts as a quality control tool in offset printing. Conductivity represents the true concentration of the font in the fountain solution for best quality print results. If pH and conductivity increases then buffer capacity gets weakened which leads to scumming, tinting etc. Therefore, the conductivity of the fountain solution should be best in order to prevent the adverse effects on print quality.

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