

CORRELATION OF SOLID INK DENSITY WITH THE SURFACE CHARACTERISTICS OF UNCOATED AND COATED (MATTE AND GLOSS) SUBSTRATES IN DROP-ON-DEMAND PRODUCTION INKJET (PIEZOELECTRIC TYPE) PRINT ENGINES

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ABSTRACT

Solid ink density is crucial print quality parameters for any printing technique. Solid Ink Density deals with the density at solid areas of print. Solid ink density is highly dependent on the type of papers used. This paper aims to find the Correlation of Solid Ink Density with the Surface Characteristics of Uncoated and Coated (Matte and Gloss) Substrates in Drop-on-Demand Production Inkjet (Piezoelectric Type) Print Engines. A test chart was prepared with the help of tint patches produced by pressSIGN 5.0 software and it was printed with the help of Drop-on-Demand (Piezoelectric) Inkjet Press. The results indicated that the coated paper stocks impart better solid ink density compared the uncoated in DOD (Piezoelectric) printing presses.

KEYWORDS: - Drop-on-Demand (Piezoelectric), Inkjet Print Engines, Solid Ink Density, Gloss Coated Paper, Uncoated Paper

INTRODUCTION

Inkjet printing is the form of printing in which ink droplets are used to print with the help of suitable programming. Production based inkjet is quite fast and it is expected to replace web offset in the future. Drop-on-demand form of inkjet printing utilizes the drops of ink in the areas only where drop is required. It is done with the help of piezoelectric crystal which swells and shrinks with the help of electric charge.

Solid ink density is the measurement of density of a solid printed patch on the paper, including the paper density. It generally relates to ink film thickness, however, a higher pigment load“ ink will measure the same density at thinner ink film thickness, and this helps in controlling dot gain while meeting density requirements.

RESEARCH OBJECTIVES

Solid ink density is one of the important print quality attributes which is required to be examined in inkjet printing process.

Objective of this paper is to correlation of Solid Ink Density with the Surface Characteristics of Uncoated and Coated (Matte and Gloss) Substrates in Drop-on-Demand Production Inkjet (Piezoelectric Type) Print Engines.

RESEARCH METHODOLOGY

Selection of Paper and Testing: - From the local market different varieties of papers were explored. The paper best matchable to ISO specifications were taken. The papers of GSM 130 for uncoated, matte coated and gloss coated papers were taken into consideration. The characteristics of papers are shown in table.1 measured in calibrated paper testing laboratory.

Master Test Chart Preparation: - A master test chart was prepared in Corel Draw Graphics Suite 2020 with the help of various elements i.e., line, text, solids, images and 234 colour gamut patches. The colour control having C, M, Y, K solids, 25%-50%-75% tint areas, slur patches and RGB were selected for master test chart with the help of PresSIGN Version 6.

Printing Work: The printing work was carried out on latest drop-on-demand Canon VarioPrint i-series inkjet press at Replica Press Pvt. Ltd., Kundli, Sonipat, Haryana,. The prints were taken in standard pressroom conditions. 200 sheets of various papers were printed and for testing purpose sheets were extracted each sheet after 20 sheets for each paper.

Solid Ink Density Measurement: - SID was measured using X-rite Exact Spectro-densitometer at Quality Control Laboratory, Department of Printing Technology, GJUS&T, Hisar.

DATA COLLECTION & ANALYSIS

Various characteristics of different paper stocks were examined in the certified paper laboratory. The data is shown in Table.1. shown below:-

Table.1. Various characteristics of different paper stocks

Paper Types	Porosity (ml/min)	Roughness (ml/min)	Gloss-Top (% ISO)	Gloss-Bottom (% ISO)	Ash Content (%)
Uncoated	160.30	110.60	28.00	27.90	10.20
Gloss Coated	131.00	10.50	75.00	72.00	13.00

Comparative Roughness Analysis: - As moved from rough uncoated to matte coated to gloss coated paper stocks, the roughness starts decreasing due to the presence of coating colour on the surface of the paper stocks (Fig.1).

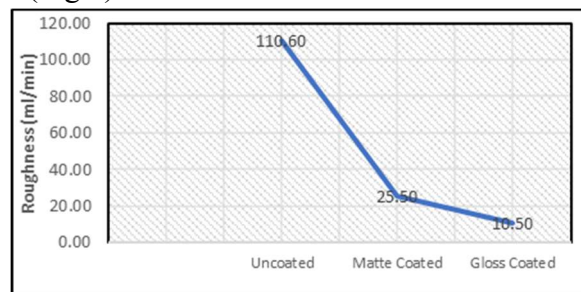


Fig.1. Comparative roughness analysis of different paper stocks

Comparative Paper Gloss Analysis: - As moved from rough uncoated to matte coated to gloss coated paper stocks, the gloss starts increasing due to the presence of coating colour on the surface of the paper stocks which gives a finished shining appearance of the surface of the paper stock (Fig.2).

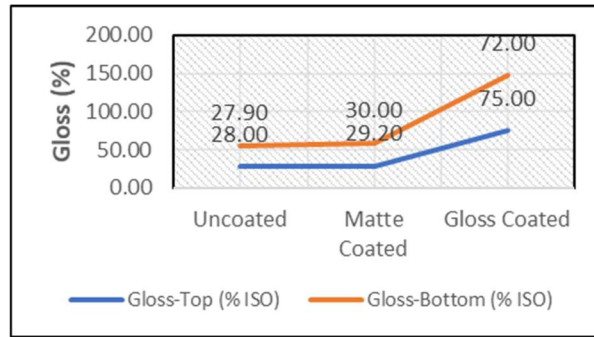


Fig.2. Comparative gloss analysis of different paper stocks

Comparative Ash Content Analysis: - As moved from rough uncoated to matte coated to gloss coated paper stocks, the Ash Content starts increasing due to the presence of coating colour inorganic particles on the surface of the paper stocks which results into better ash content for the specific paper stock (Fig.3).

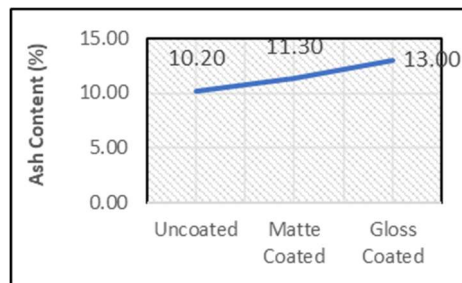


Fig.3. Comparative Ash Content analysis of different paper stocks

Comparative Paper Porosity Analysis: - Porosity of uncoated paper stock is found more compared to the matte and gloss coated paper stocks. Porosity is reduced because the pores of uncoated paper stocks are filled up by the coating pigments (Fig. 4).

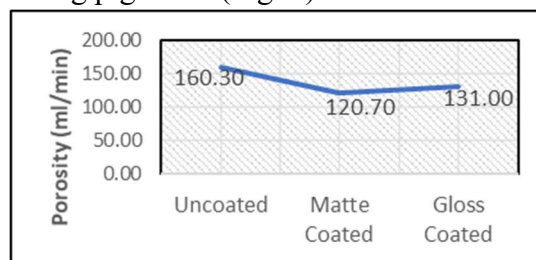


Fig.4. Comparative porosity analysis of different paper stocks

RESULTS & DISCUSSIONS

Effect on Solid Ink Density: - From the Fig.5, Table 2 it is quite evident that Solid Ink Density of uncoated paper stock is found minimum in all the three presses of the study. While moving from uncoated to coated stocks, print contrast is increased. The possible reason might be the presence of roughness and pores on the surface of the uncoated papers which causes quite less ink holdout on the surface of the uncoated paper and finally density of ink is lost to an extent. On the other hand, the density is found more on the coated paper stocks due to filled surface structure of the paper stocks. More ink holdout results in less density loss after the printing and hence print contrast

is found more on coated paper stocks compared to uncoated. DOD presses have shown better print contrast compared to the CIJ presses.

Table.2. SID Values of Piezoelectric press on different types of paper stocks

	C	M	Y	K
UC	1.3	1.35	1	1.5
MC	1.5	1.45	1.1	1.7
GC	1.55	1.5	1.15	1.75

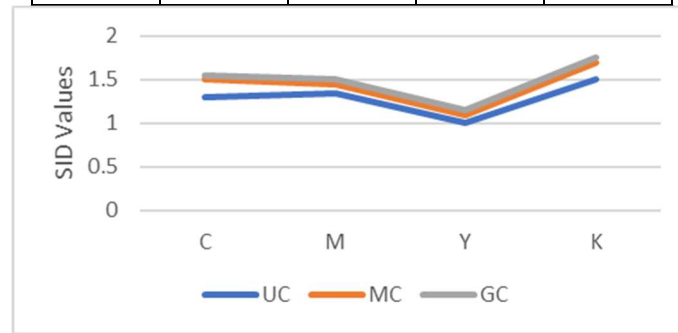


Fig.5. SID of Piezoelectric press on different types of paper stocks

CONCLUSION

DOD (Drop-on-demand) presses show better SID on the coated (Gloss and Matte) paper stocks compared to the uncoated. In the continuous inkjet drops are directly bombarded onto the paper surface causing ink to spread inside the paper structure and which further causes density loss. The matte and gloss coated paper stock exhibit better print density compared to the uncoated paper stocks, due to more ink hold out.

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