



COMPARATIVE ANALYSIS OF THE IMPACT OF SOLID INK DENSITY OF MATTE-ART, GLOSS ART AND HIGH GRADE LITHO PAPER ON DOT GAIN IN SHEET-FED OFFSET PRINT QUALITY

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ABSTRACT

Sheet-fed printing is a high-quality printing method which is defined as the technique in printing in which the image having ink or offset is transferred to a rubber blanket to the printing surface from a plate. Dot gain is a printing phenomenon that causes printed material to seem darker than intended in offset lithography and other kinds of printing. Solid Ink Density is the quantity of ink deposited to the paper during the printing process. In this research, the values of dot gain and solid ink density of Matte-Art paper, Gloss-Art paper and High-Grade Map-Litho paper were measured using Spectro densitometer. Results indicated that increase in solid ink density led to increase in dot gain values.

KEYWORDS: Sheet-fed printing, Matte-Art Paper, Gloss-Art Paper, High Grade Map-Litho Paper, Trapping Value, Thickness.

1. INTRODUCTION

Sheet-fed offset printing is a high-quality printing method that employs either individual sheets of paper manually fed into the printing machine, or a continuous-feed roll of paper that can be cut during the printing process. It is defined as the technique in printing in which the image having ink or offset is transferred to a rubber blanket to the printing surface from a plate. Sheet-fed offset printing depends on many factors like supply of ink, time of contact among the printing components, printing pressure, rheological properties, temperature ratios and printing surface properties. A sheet-fed press has a feeder, one or more printing units, a sheet register system along with transfer devices which helps in moving the paper in the machine, three primary cylinders (plate cylinder, blanket cylinder and impression cylinder) with the systems for dampening and inking the plate. The printing substrates which were chosen for the research are Matte-Art paper, Gloss-Art paper and High-grade Map Litho paper.

The physical characteristics which have been chosen for this research are Solid Ink Density and Dot Gain. Solid Ink Density is the quantity of ink deposited to the paper during the printing process. When the density of solid ink is raised, the contrast is increased to a certain extent. The contrast is then reduced as the reproduction becomes darker. The latter occurs when midtone values fill in (comers begin to join) and shadow regions begin to block up.

The words "fill-in" and "plug-in" refer to different types of dot gain. Fill-in and plug-up are two terms that are sometimes used interchangeably to describe the circumstance in which ink fills the space between halftone dots or plugs up the type. It's important to remember that raising solid ink density also improves middle tone densities and dot gain. Too much ink in one spot creates undesired colour changes in the wrong spot, which is bad for reproduction. There is no such thing as too little ink.



2. RESEARCH OBJECTIVES

The objective of this research is to compare the Impact of solid ink density of Matte-Art, Gloss Art, and High Grade Litho paper on dot gain in sheet-fed offset print quality.

3. RESEARCH METHODOLOGY

In this research, the case study was conducted in the Guru Jambheshwar University of Science and Technology's Printing Technology's laboratory. The test papers were prepared in a conditioning chamber at $23\pm 1^\circ\text{C}$ and 65 percent relative humidity in compliance with the TAPPI T 402 om-88 standard. Heidelberg Speed master CD 102 printing machine was used for offset printing. Each sample consisted of 500 prints was taken into consideration. After that, three samples were picked at random from the 100th, 300th, and 500th prints. Exact Spectro-Densitometer was used to determine the values of solid ink density and dot gain. With the results from each of the three samples, the mean values were computed. The ISO 12647-2 standard was used to apply these printing characteristics. The papers which were considered for testing included-Matte art, Gloss art and Map-litho. The grammage of above-mentioned papers ranging from 70 to 120 gsm was taken into consideration.

4. DATA COLLECTION AND ANALYSIS

Offset printing is an indirect lithographic technique in which ink from a plate is transferred to a blanket, which is subsequently transferred to a substrate. To achieve a proper balance with the ink in the offset printing process, a water-based solution known as the dampening solution is employed.

Colour saturation, colour intensity, image darkness, and dot gain are all affected by Solid Ink Density (SID), or the quantity of ink deposited to the paper during the printing process. When the density of solid ink is raised, the contrast is increased to a certain extent. The contrast is then reduced as the reproduction becomes darker. The latter occurs when middletone values fill in (comers begin to join) and shadow regions begin to block up.

The words "fill-in" and "plug-in" refer to different types of dot gain. Fill-in and plug-up are two terms that are sometimes used interchangeably to describe the circumstance in which ink fills the space between halftone dots or plugs up the type. It's important to remember that raising solid ink density also improves middle tone densities and dot gain. Too much ink in one spot creates undesired colour changes in the wrong spot, which is bad for reproduction. There's no such thing as too little ink.

Table: 1 Values of Solid-Ink Density in random Samples

Print Number	Matte-Art				Gloss-Art				High grade Map-Litho			
	C	M	Y	K	C	M	Y	K	C	M	Y	K
100 th	1.28	1.27	1.25	1.30	1.08	1.07	1.06	1.05	0.80	0.75	0.85	0.80
300 th	1.26	1.25	1.26	1.29	1.06	1.05	1.06	1.07	0.84	0.82	0.85	0.86
500 th	1.29	1.28	1.27	1.31	1.05	1.04	1.06	1.05	0.81	0.81	0.80	0.82

Table 2: The Average Solid Ink Density of the offset printed papers

S. No.	Features	Matte	Gloss	High Grade Map-Litho
1.	Cyan-C	1.28	1.06	0.82
2.	Magenta-M	1.27	1.05	0.79
3.	Yellow-Y	1.26	1.06	0.83
4.	Key-K	1.3	1.06	0.83

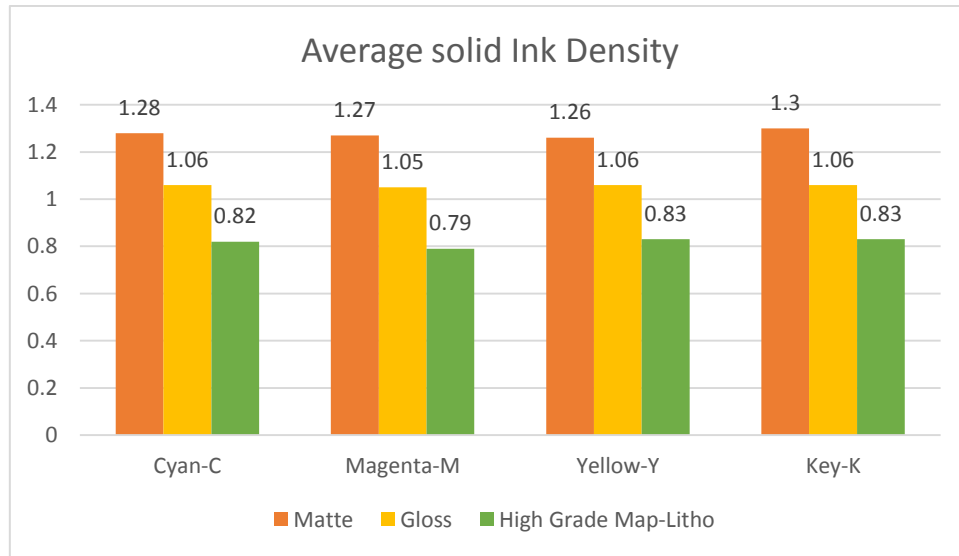


Fig.1. Average solid Ink density of different papers

Print Number	Matte-Art				Gloss-Art				High grade Map-Litho			
	C	M	Y	K	C	M	Y	K	C	M	Y	K
100 th	16.2	14.2	15.2	12.5	16.1	15	15	9	13.5	12.5	12.5	9.1
300 th	16.3	14.3	15.1	12.4	16.2	14	15	9.4	13.6	12.4	12.1	8.5
500 th	16.4	14.6	15.4	12.8	16.3	13	15	9.2	13.7	12.8	12.8	8.2

S. No.	Features	Matte	Gloss	High Grade Map-Litho
1.	Cyan-C	16.3	16.2	13.6
2.	Magenta-M	14.4	14	12.6
3.	Yellow-Y	15.2	15	12.5
4.	Key-K	12.6	9.2	8.6

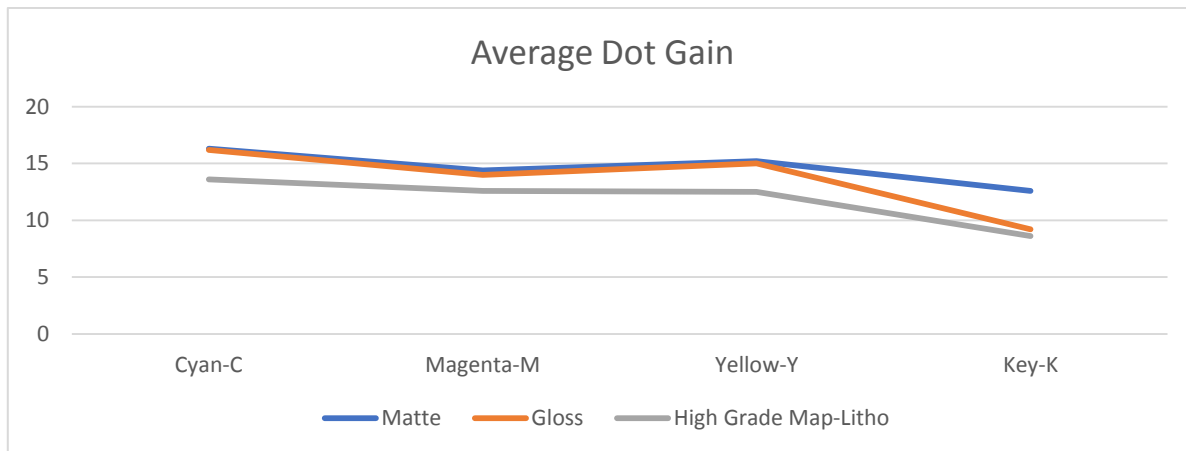


Fig.2. Average Dot gain of different papers

Table 5: Solid Ink Density vs Dot Gain

S. No.	Features	Matte Art		Gloss Art		High Grade Map-Litho	
		Solid Ink Density	Dot Gain	Solid Ink Density	Dot Gain	Solid Ink Density	Dot Gain
1.	Cyan	1.28	16.3	1.06	16.2	0.82	13.6
2.	Magenta	1.27	14.4	1.05	14	0.79	12.6
3.	Yellow	1.26	15.2	1.06	15	0.83	12.5
4.	Key	1.3	12.6	1.06	9.2	0.83	8.6

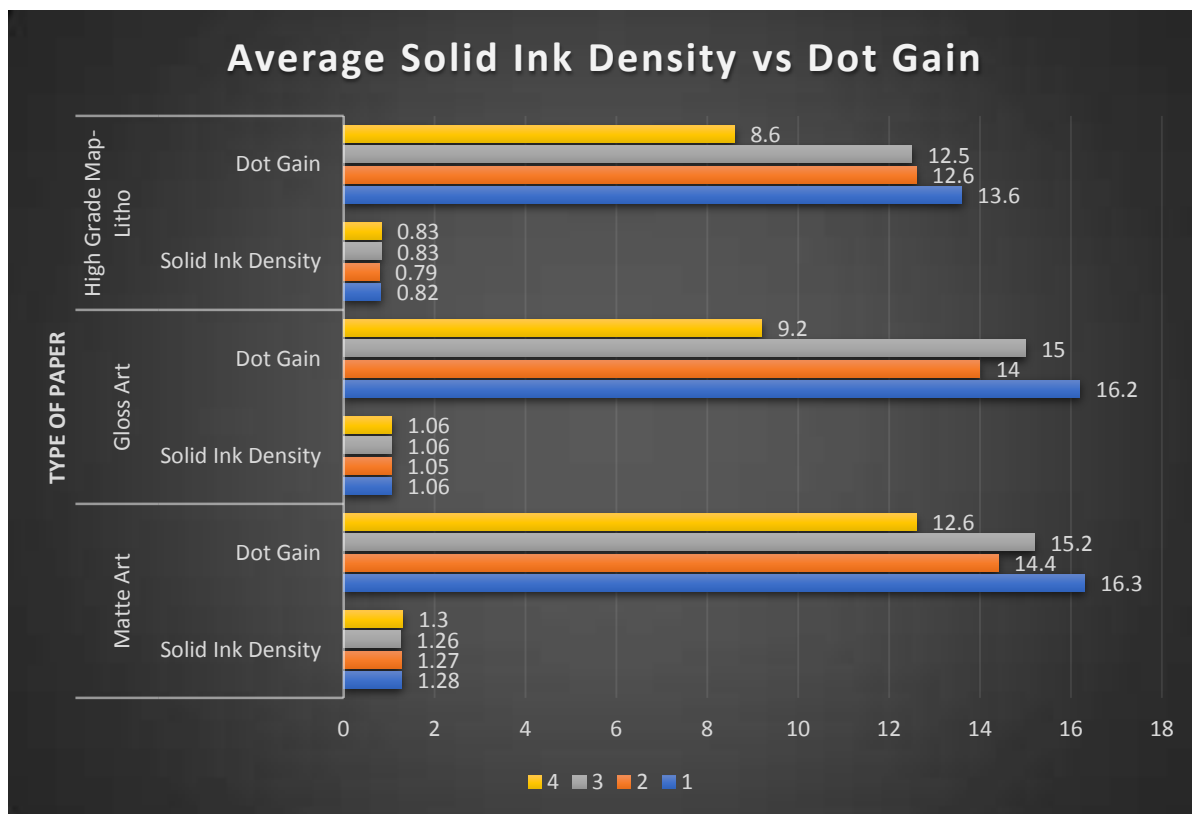


Fig.3. Comparison of Solid Ink Density and Dot Gain



5. RESULT AND DISCUSSION

After analysing the data collected through different tests, the observations are as follows-

- **Comparison between Average Solid Ink Density and Average Dot Gain**

It is found that the average Solid Ink Density for Cyan colour is 1.28, for Magenta is 1.27, for yellow colour is 1.26 and for key is 1.3 as far as Matte Art paper is concerned. On the other hand, the dot gain values for respective colours for Matte Art paper are 16.3, 14.4, 15.2 and 12.6. Moreover, for Gloss Art the values of solid ink density get decreased as 1.06, 1.05, 1.06 and 1.06 respectively for each colour and so as the values of dot gain as 16.2, 14, 15 and 9.2 respectively. When it comes to High-grade map litho then the values for both solid ink density and dot gain is the least. As per the observations value of solid ink density for cyan colour is 0.82, for Magenta, it is 0.79, for Yellow is 0.83 and for Key it is 0.83. As far as values of dot gain for CMYK for High Grade Map litho are concerned the values are 13.6, 12.6, 12.5 and 8.6 respectively. This clearly shows that the increase in the Solid Ink Density results into increase in Dot Gain.

6. CONCLUSION

After the analysis of collected data, it is concluded that there is a direct relationship between solid ink density and dot gain in the offset printing for Matte Art paper, Gloss Art paper and High-grade Map Litho paper. In other words, on increasing solid ink density, dot gain increases and vice-versa.

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