Section: Research Paper
ISSN 2063-5346

COMPARATIVE PRINT-EDGE ANALYSIS OF SHEET-FED OFFSET AND DRY ELECTROPHOTOGRAPHY (DEP) PRINTING TECHNIQUES BY HUMAN STANDARD OBSERVER METHOD

Sumit Kumar[1], Nishant Tarar[2], Divyakshi[3]

1. Faculty, Delhi Skill & Entrepreneurship University, Pusa Campus, New Delhi
2. Research Scholar, Department of Printing Technology GJUS&T, Hisar
3. Research Scholar, Department of Printing Technology GJUS&T, Hisar

Published: 17-June-2023 Accepted: 13-May-2023

ABSTRACT

A number of printing processes have come to exist in the printing world to cope up with ever-changing demands of the printers and customers. Two major printing processes which are used to print the cellulosic substrates are Sheet-fed Offset and Dry Electro-photography (DEP) technologies. Objective of this paper is to compare the Print-edges of Sheet-fed Offset and Dry Electro-photography (DEP) technologies by Human Standard Observer Method. A master test chart was prepared in Corel Draw Graphic Suit 20, using various test image elements i.e., line drawing, continuous tone and solid images and printed with Sheet-fed Offset and Dry-toner Electrophotographic presses available in the local market on uncoated, matte coated and gloss coated papers. The print-edge testing factors taken into the consideration were Raggedness, Blurriness, Contrast and Fill as per ISO 13660. Print-edge evaluation was carried out with the help of Standard Humans Observers who passed the Munsell Test. The average results of twenty observers were taken and forwarded for results and discussions.

KEYWORDS: - Sheet-fed Offset, DEP (Dry Electro-photography), Human Standard Observer, Raggedness, Blurriness, Contrast, Fill

INTRODUCTION

Sheet-fed offset printing is a popular printing process which can achieve or maintained high quality of print on high speed. In this process both image area and non-image area are on the same plane but separated by chemically hence a fountain solution is needed to separate the non-image area from the image area and paste type of ink is used for print image on the substrate i.e., Cellulose Papers (Baral, A.K., 2008). On the other hand, Dry Electro-photography (DEP) is a digital printing process in which ink is transferred to a photo conductive drum in the dry powder form and which is finally fused on to the substrate with the help of heat and pressure (Barney Smith, E. H., 2010). DEP is replacing the conventional sheet fed offset because of its short run capability and personalization benefits.

A number of research work has been already carried out between sheet fed offset and DEP to find out the quality gap. Various print quality attributes taken into consideration are Solid Ink Density, Dot Gain and Print Contrast etc. ISO 13660 defines various print quality factors of DEP office printers which include Line drawing attributes i.e., Raggedness, Blurriness, Contrast and Fill (ISO 13660). These attributes can help the printers significantly to make a healthy print edge quality comparison between above mentioned presses.

Section: Research Paper
ISSN 2063-5346

RESEARCH OBJECTIVE

With the passage of time, DEP presses are acquiring the market share of sheet-fed offset especially for the short run job. But there is a point of strong concern among the printers and customers regarding the quality gap between sheet-fed offset and DEP presses. For the better understanding of the print quality, ISO 13660 has been studied and factors related to ISO 13660 have been taken to make the print-edge quality comparison. Objective of this paper is to compare the Print-edges of Sheet-fed Offset and Dry Electro-photography (DEP) technologies by Human Standard Observer Method.

RESEARCH METHODOLOGY

A master test chart was prepared with the help of line drawings, continuous tone, solid images and tint patches of cyan, magenta, yellow and black. The test chart was printed with the help of sheet-fed offset and DEP presses in the local market. Further the print quality attributes as per ISO 13660 were taken into the consideration i.e., Print-edge raggedness, blurriness, contrast and fill (figure 1).

Figure.1. Various print quality attributes as per ISO 13660 (ISO 13660)

These print-edge quality attributes were analysed with the help of standard human observer method. The persons having the age above 18 years who passed the Munsell test (figure 2) of colour blindness getting the marks below 2 were called as human standard observers. Total 20 observers were given the sheets for evaluating and analysing the print-edge quality on the scale of 1-10; 1 represented the lowest and 10 represented the highest value of the print-edge quality attribute.

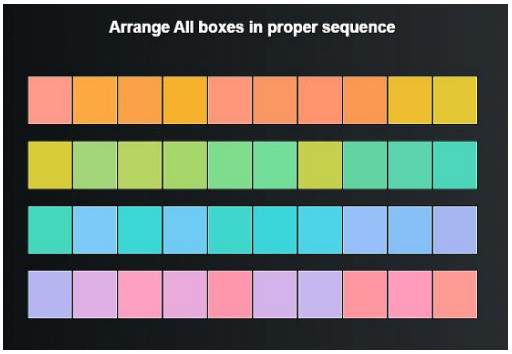

Figure.2. Munsell Test (Colour blindness test)

The observation was made with the help of 10x zoom eye-lens and readings were taken from the distance of 30 cm distance. The average of 20 observers was taken and calculated along with standard deviations. With the help of tables and bar charts the data was analysed for the results and discussions.

DATA COLLECTION & ANALYSIS

Table.1. Print-edge Raggedness on Sheet-fed offset and DEP presses

	Uncoated	**Matte Coated**	**Gloss Coated**
Sheet fed offset	6.45	5.30	4.45

DEP	7.60	5.65	5.20
SD-I	0.6863	1.1743	0.9445
SD-II	0.8208	1.0400	1.1965

It is observed in table 1, that the raggedness values of Sheet-fed Offset are (6.45, 5.30 and 4.45) which are lower than the values of Dry Electro-photography (7.60, 5.65 and 5.20) on all types of papers i.e., Uncoated, Matte Coated and Gloss Coated. SD-I is representing the values of standard deviation in Sheet-fed Offset data and SD-II represents the standard deviation in the Dry Electro-photography as well. The collected data shows that the raggedness of the prints is on the higher side in DEP press as compare with the Sheet-fed Offset Press.

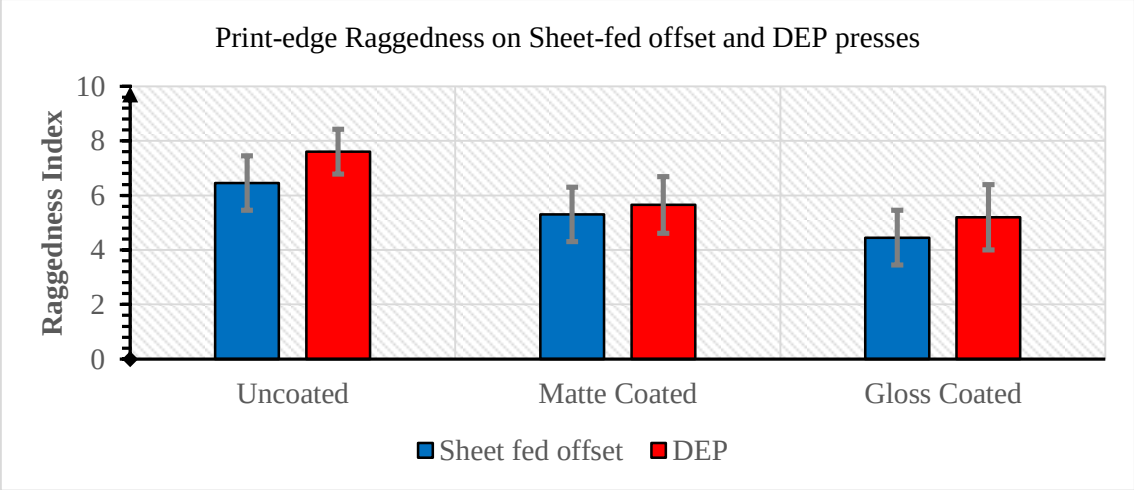

Figure.3. Comparative analysis of Print-edge Raggedness on Sheet-fed offset and DEP presses

Figure 3 is a graphical representation of collected data one of the most valuable attributes of print edge quality check. It is found that the raggedness values of DEP (Dry Electro-photography) on Uncoated, Matte coated and Gloss coated papers on the higher peak as compared to the Sheet-fed Offset press.

Table.2. Print-edge Blurriness on Sheet-fed offset and DEP presses

	Uncoated	**Matte Coated**	**Gloss Coated**
Sheet fed offset	7.45	6.10	5.45
DEP	6.25	5.10	4.40
SD-I	0.9445	0.9679	1.0501
SD-II	0.9665	0.9687	1.0463

Table 2 represent the Print-edge Blurriness values, which are on higher side in Sheet-fed Offset press i.e., 7.45, 6.10 and 5.45 on Uncoated, Matte coated and Gloss coated papers respectively but on the other hand these values are 6.25, 5.10 and 4.40 in Dry Electro-photography. Standard deviation is ranged between 0.9445 to 1.0501 in the case of sheet-fed offset press and in case of DEP press it is ranged between 0.9665 to 1.0463.

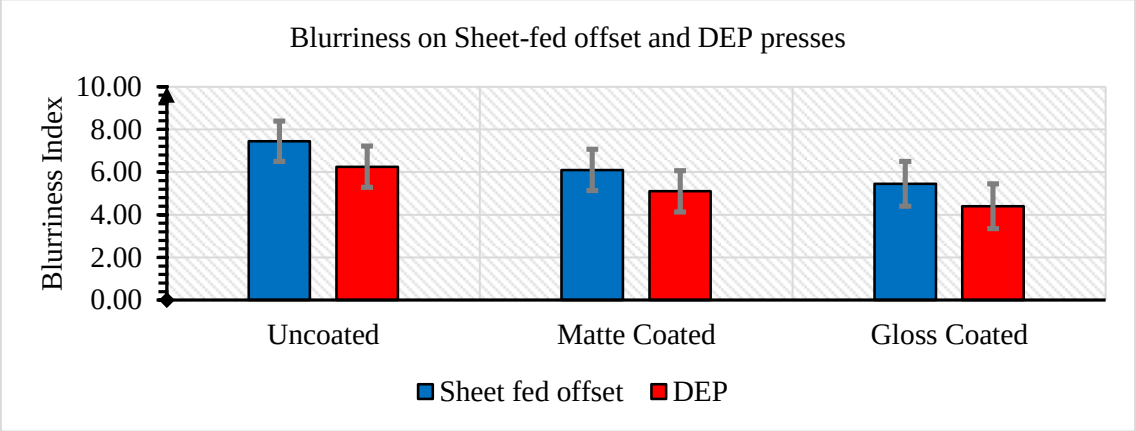

Figure.4. Comparative analysis of Print-edge Blurriness on Sheet-fed offset and DEP presses

Figure 4 represented that the blurriness on print-edge quality is higher in sheet-fed offset press on uncoated, matte coated and gloss coated compared with dry electro-photography.

Table.3. Print-edge Contrast on Sheet-fed offset and DEP presses

	Uncoated	Matte Coated	Gloss Coated
Sheet fed offset	4.45	6.90	7.80
DEP	5.55	6.00	7.20
SD-I	0.9445	0.9119	0.7678
SD-II	0.8256	1.1239	0.7678

Print-edge contrast is playing a major role in print quality attributes and when this attribute was compared on sheet-fed offset and dry electro-photography it was found that the result based on the types of papers. It was represented in the table 3 that in case of the DEP press the values of print-edge contrast on higher side i.e., 5.55 on Uncoated paper but on the matte coated and gloss coated paper the values are shift on the lower side compared with the sheet-fed offset press.

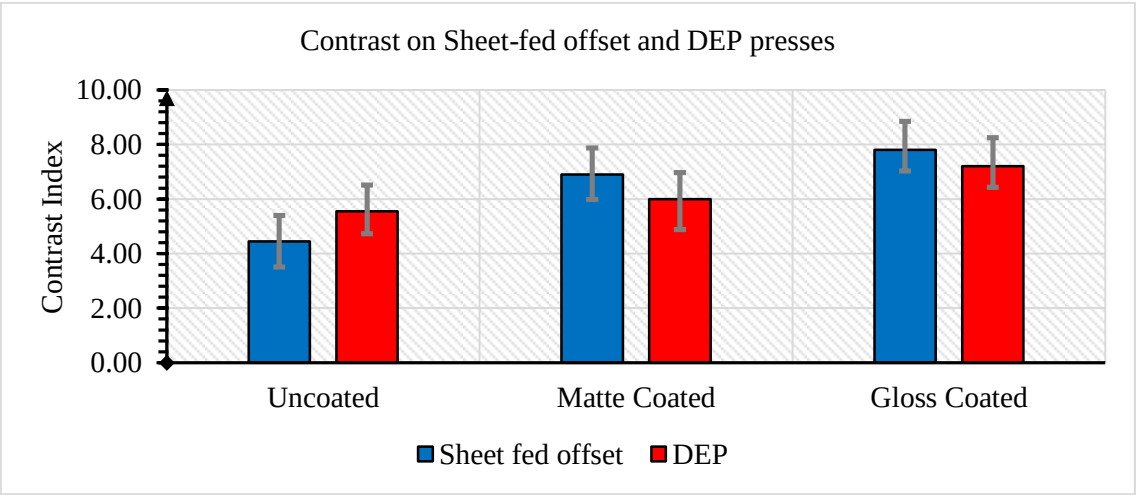

Figure.5. Comparative analysis of Print-edge Contrast on Sheet-fed offset and DEP presses

Comparative analysis of print-edge contrast is represented in figure 5 and it is found the on the uncoated paper the values of print-edge contrast was higher in DEP press but on the matte coated and gloss coated paper the values of print-edge contrast was higher in sheet-fed offset press.

Section: Research Paper
ISSN 2063-5346

Table.4. Print-edge Fill on Sheet-fed offset and DEP presses

	Uncoated	Matte Coated	Gloss Coated
Sheet fed offset	6.10	7.80	8.30
DEP	6.50	7.50	8.10
SD-I	0.7182	0.9515	0.8013
SD-II	1.0000	0.8272	0.7881

Print-edge fill data is observed in table 4 and it is found the values of print-edge fill are high in sheet-fed offset press on matte coated and gloss coated i.e., 7.80 and 8.30 respectively compared with DEP press. When the values are observed on uncoated paper the result found opposite and it is found that the values of print-edge fill on higher side in DEP press compares with the sheet-fed offset press.

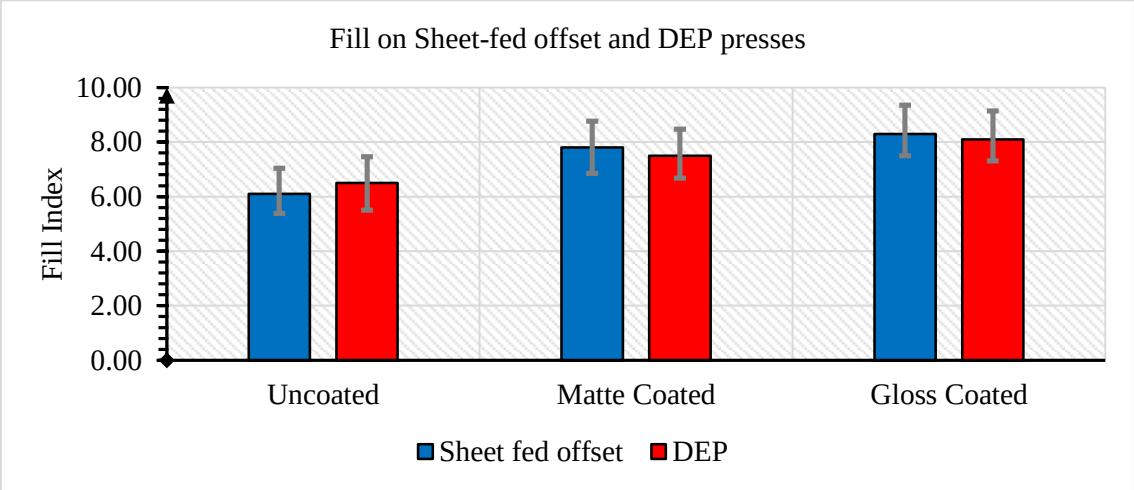

Figure 6. Comparative analysis of Print-edge Fill on Sheet-fed offset and DEP presses

Figure 6 represented that the values of print-edge fill values are high on matte coated and gloss coated papers compared to uncoated paper, but when the comparison between sheet-fed offset and DEP press it is found that the print-edge fill values are high in DEP press on uncoated paper but values are lower on matte coated and gloss coated compared with the sheet-fed offset press.

RESULTS & DISCUSSION

Print-edge Raggedness Analysis

Print-edge raggedness is described as the distortion of Print-edge from its ideal position. More the print-edge raggedness means more rough and wavy edge of print instead of smooth or straight print edge. When it was compared on the sheet-fed offset and DEP data which was represented in table 1 and it was found that the print-edge raggedness is on higher side in case of DEP press on uncoated, matte coated and gloss coated papers.

Print-edge Blurriness Analysis

Print-edge blurriness is described as the being hazy or indistinct in outline of the print; and it is found that a shadiness formation is formed at the edges of the print. While it was compared in sheet-fed offset and DEP presses on the uncoated, matte coated and gloss coated papers as represented in table 2 it is found that the values of print-edge blurriness are on higher side in case of sheet-fed offset press. when sheet-fed offset printed sheets are observed it is found that on the edge of print blurriness was formed because of repulsive nature in ink and dampening solution.

Section: Research Paper
ISSN 2063-5346

Print-edge Contrast Analysis

"Print contrast" is a term used in printing to describe the difference in darkness or colour intensity between the printed text or images and the background on which they are printed. It refers to the visual distinction between the inked areas and the non-inked areas on a printed page**.** In table 3 print-edge contrast was compared in sheet-fed offset and DEP presses on uncoated, matte coated and gloss coated papers. It was found that the contrast was on higher side in DEP press on uncoated paper as compare with sheet-fed offset press, because of uncoated paper absorbed more ink and the image area was formed denser but in case of matte coated and gloss coated papers contrast values are found higher in sheet-fed offset press.

Print-edge Fill Analysis

Print-edge fill is homogeneity of darkness within the line, image and characters, it is measured as the ration of the area with 75% relative reflectance value within the inner boundary to the total area within the inner boundary. In table 4 the print-edge fill is compared in sheet-fed offset and DEP press on uncoated, matte coated and gloss coated papers. After observe the values of table 4 it is found the print-edge fill values are on higher side in case of DEP press on uncoated paper but on matte coated and gloss coated paper values are on higher side in case of sheet-fed offset press. It was found that the uncoated paper absorbed more ink in sheet-fed offset press but in case of matte coated and gloss coated papers ink was distributed or fill in the character in sheet-fed offset press.

CONCLUSION

The following points are concluded on the basis of results and discussions.

1. Print-edge Raggedness is found more in DEP press compared with the Sheet-fed printing presses on uncoated, matte and gloss coated papers.
2. Print-edge Blurriness was found more in the case of Sheet-fed offset printing press as compared to the DEP presses on uncoated, matte coated and gloss coated papers.
3. Print-edge contrast was found more on DEP press in the case of uncoated paper but in the case of matte and gloss coated papers, the result is opposite i.e., the Print-edge contrast was found more on sheet-fed offset press instead of DEP press.
4. Print-edge fill tendency was found more on DEP press in the case of uncoated paper, but when the results are compared on the matte and gloss coated papers, the results are found different. Print-edge fill value was resulted more on Sheet-fed offset printing press in the case of matte and gloss coated papers compared to DEP presses.

REFERENCES

- Adams, J. M., Faux, D. D., & Rieber, L. J. (1996). Printing Technology (4th ed.). Albany, NY, Delmar Publishers.
- Baral, A.K. (2008). Print Quality of Sheet Fed Offset & Digital Printing Technologies. IPPTA J. Vol.20, No. 4, Oct-Dec, 91-92.
- Barney Smith, E. H. (2010). Relating electro-photographic printing model. (Doctoral dissertation).
- Briggs, J.C.; Klein, A.H. & Tse, M.K. (1999). Applications of ISO-13660, A New International Standard for Objective Print Quality Evaluation. Imaging Society of Japan, Tokyo, Japan

- Burns, P.D. (2014). Edge-Raggedness Evaluation Using Slanted-Edge Analysis. Eastman Kodak Company, Rochester, NY USA 14650-1925.
- Colorblindnesstest (2023). https://www.colorblindnesstest.org/farnsworth-munsell-100-hue-test/
- Dhirender, Garg, H & Rajeev (2017). Identification and Characterization of printing process on the basis of Print edge analysis. International Journal of science and Computer Technology 7(2), 103-104.
- Hamerly, J.R. & Springer, R.M. (1980). Raggedness of edges. Vol. 71, No. 3/March 1981/J. Opt. Soc. Am.
- ISO 13660, International standards (2001).
- TGI Corp. (2007). How digital printing works.
- Thompson, B. (1998). Printing Materials: Science and Technology, Pira International. pp 410-431.