

Comparative Colour Gamut Analysis of Piezoelectric Inkjet (PIJ) And Sheet-Fed Offset Printing Technologies

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Abstract: This paper presents a comprehensive comparative analysis of the colour gamut achieved by Piezoelectric Inkjet (PIJ) and Sheet-Fed Offset printing technologies. The colour gamut, a crucial aspect of print quality, is a measure of the range of colours a printing process can reproduce. Both PIJ and Sheet-Fed Offset printing are widely employed in various industries, including graphic arts and commercial printing. The research methodology involves the characterization of the colour gamut of PIJ and Sheet-Fed Offset printing through empirical experiments and spectral measurements. A diverse set of colour targets is used to assess the gamut volume, including standard colorimetric tests such as colour gamut volume measurements. The study also considers factors such as substrate type, ink formulations, and printing conditions to provide a comprehensive understanding of the gamut limitations and advantages of each technology. Results reveal the strengths and weaknesses of both printing methods in terms of colour reproduction, highlighting areas where one technology may outperform the other. Insights gained from this comparative analysis can inform decision-making processes for print industry professionals, helping them choose the most suitable printing technology based on specific project requirements and desired colour outcomes. Ultimately, this research contributes valuable knowledge to the ongoing discourse on print technology selection, aiding in the optimization of colour reproduction processes for diverse applications ranging from high-quality graphics to commercial printing.

Keywords: - Piezoelectric Inkjet (PIJ), Sheet-fed offset, colour gamut, print quality, colour gamut volume, Spectro-photometer.

1. Introduction

Sheet feed Offset Printing: Sheet-fed offset printing is a widely used printing technique that involves individual sheets of paper fed into the printing press. It's commonly employed in commercial printing for items such as brochures, stationery, posters, and other high-quality printed materials. This method uses a process where ink is transferred from a plate to a rubber blanket and then onto the printing surface. Sheet-fed offset printing offers high quality and flexibility, allowing for precise colour control and the ability to print on various paper types.

Colour Gamut: The colour gamut in sheet-fed offset printing refers to the range of colours that can be accurately reproduced using this printing method. Offset printing typically uses the CMYK colour model, which stands for cyan, magenta, yellow, and black. These colours are printed in tiny dots and combined in varying percentages to create a wide spectrum of hues, shades, and tones. Offset printing's strength lies in its ability to maintain consistent and accurate colour reproduction, making it a preferred choice for high-quality, large volume printing projects where colour consistency and quality are essential. Techniques like Pantone matching systems can also be used in offset printing to extend the colour gamut and achieve specific, precise colours beyond the CMYK range.

PIJ: Piezoelectric inkjet is a printing technology used in inkjet printers. It's named after the piezoelectric materials used in the printheads. In this printing method, tiny piezoelectric elements in the printhead change shape when an electric current is applied. This change in shape generates pressure, which expels ink droplets through the print nozzles onto the printing surface. Piezo inkjet technology allows for precise control over droplet size and placement, resulting in high-quality prints with fine details. It's known for its ability to accommodate a wide range of inks, including solvent-based, aqueous, UV-curable, and other specialty inks. This versatility makes piezo inkjet technology suitable for various applications, including graphic arts, textiles, signage, and industrial printing.

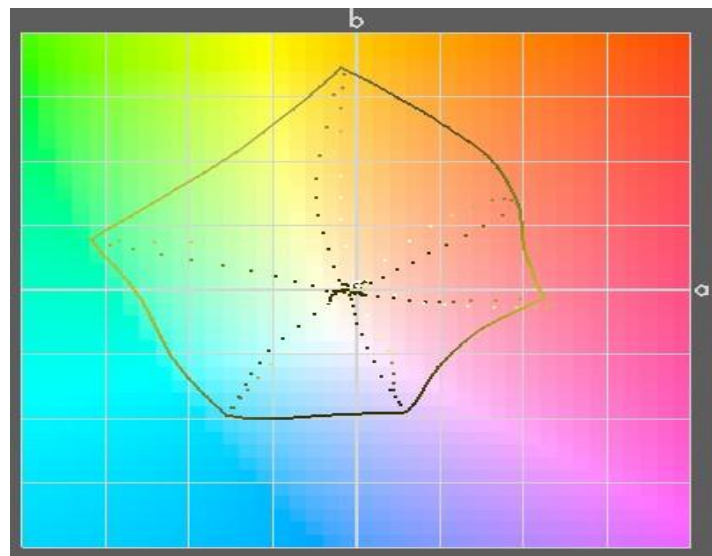


Fig 1: Colour Gamut representation on Lab Colour Space

The colour gamut in piezo inkjet printing refers to the range of colours that can be reproduced using this specific printing technology. The gamut in inkjet printing, including the piezo inkjet method, is determined by the type of inks used, the quality of the printer, and the materials onto which the ink is being applied.

2. Research Objective

There is a point of strong concern among the printers and customers regarding the colour gamut analysis between piezoelectric (PIJ) and sheet-fed offset presses. Measure and characterize the colour gamuts of Piezoelectric Inkjet and Sheet-Fed Offset printing technologies using standardized colorimetric tests, such as gamut volume measurements on uncoated, gloss coated and matte coated paper, to provide a quantitative understanding of the achievable colour spaces.

3. Research Methodology

The colour gamut chart was printed with the help of piezoelectric (PIJ) and sheet-fed offset printing presses available in the local market. Further the gamut volume tested with the help of Spectro-photometer available in the department of Printing Technology GJUS&T Hisar and calculate the colour gamut volume by colour think software. Creating a device profile generally involves five steps:

- A. Calibrate the device
- B. Print, Display and Scan a test chart
- C. Measure the test chart
- D. Use profiling software
- E. Produce a profile

4. Data Collection & Analysis

Table 1: Colour Gamut Volume of PIJ and Sheet-fed Offset Printing Presses

	UC	MC	GC
Piezoelectric Inkjet	213466	324268	345021
Sheet-fed offset	281799	354987	374652

It is observed in the table 1, that the colour gamut volume of sheet-fed offset are 281799 on uncoated paper, 354987 on matte coated and 374652 on gloss coated paper which is higher than the colour gamut volume

Piezoelectric Inkjet. The values of colour gamut volume on gloss coated paper is higher in both of the presses as compare with the Uncoated and Matte coated papers.

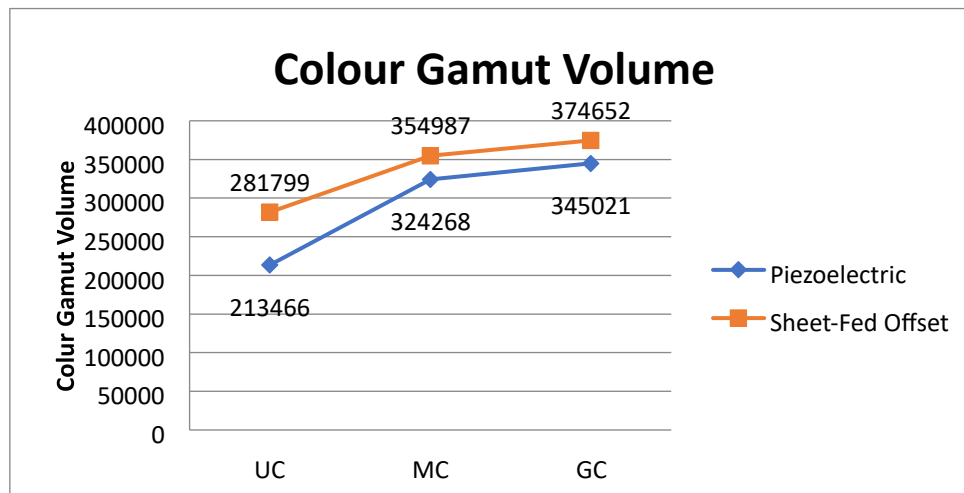


Fig 2: Comparative analysis of Colour Gamut Volume of Piezoelectric Inkjet (PIJ) and Sheet-fed offset on Uncoated (UC), Matte Coated (MC) and Gloss Coated (GC) Paper

Figure 2 is a graphical representation of collected data of colour gamut volume and it is found that the sheet-fed offset press have the higher values of colour gamut volume as compare with piezoelectric inkjet press, but when the comparison between uncoated, matte coated and gloss coated paper it is found that the gloss coated paper has the highest values of colour gamut volume and uncoated paper have the lowest values of colour gamut volume.

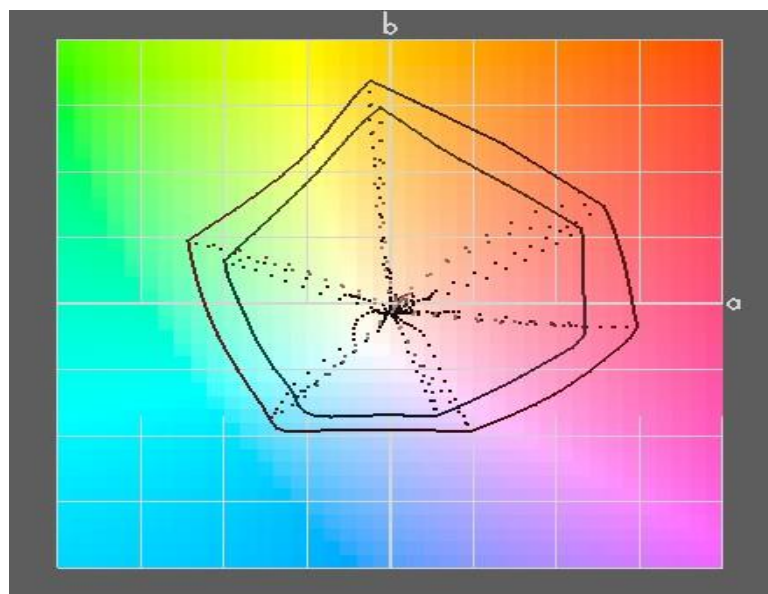


Fig 3: Comparative analysis of Colour Gamut Volume of Piezoelectric Inkjet (PIJ) and Sheet-fed offset on Uncoated (UC) Paper

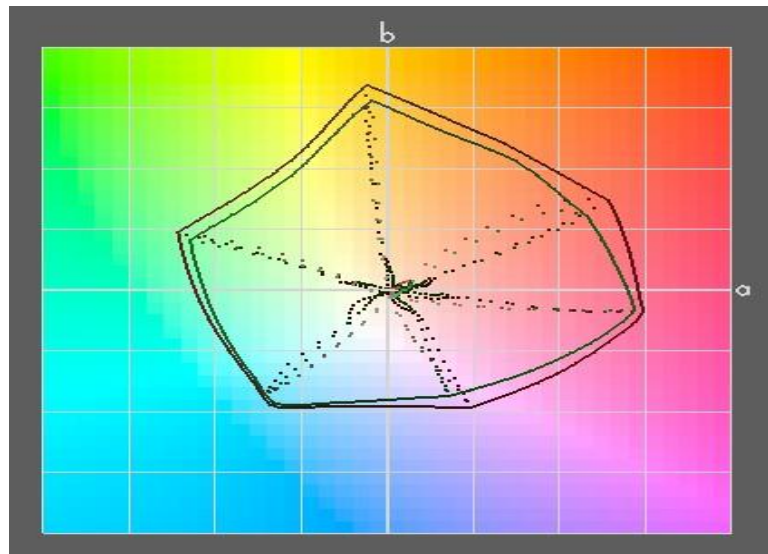


Fig 4: Comparative analysis of Colour Gamut Volume of Piezoelectric Inkjet (PIJ) and Sheet-fed offset on Gloss Coated (GC) Paper

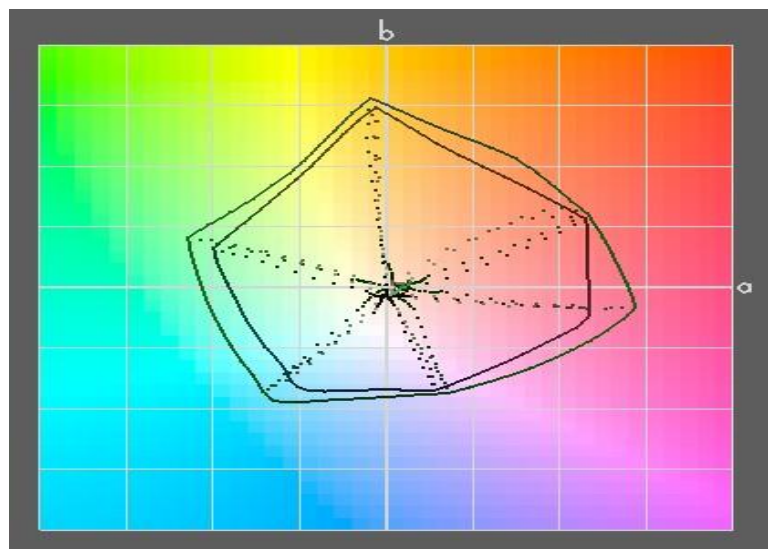


Fig 5: Comparative analysis of Colour Gamut Volume of Piezoelectric Inkjet (PIJ) and Sheet-fed offset on Matte Coated (MC) Paper

5. Results & Discussion

Colour gamut volume refers to the range of colours that a display device or imaging system is capable of producing. It is a three-dimensional space that represents all possible colours that the device can reproduce. The three dimensions typically correspond to the red, green, and blue colour channels. The unit of measurement for colour gamut volume is often expressed in terms of a percentage of a standard colour space, such as sRGB or Adobe RGB.

The concept of colour gamut volume is important in various fields, including photography, graphic design, and display technology. A larger colour gamut volume generally indicates that the device is capable of reproducing a wider range of colours, which can be beneficial in applications where colour accuracy and vibrancy are crucial. Different devices and standards may have different specifications for colour gamut volume. For example, high-end monitors and professional-grade printers often strive for a wider colour gamut to meet the

demands of professional users who require precise colour reproduction. Understanding the colour gamut volume of a device is essential when working on projects where colour accuracy is critical. It is found that the colour gamut volume of Sheet-fed offset press is higher than the piezoelectric inkjet presses on uncoated, matte coated and gloss coated papers.

6. Conclusion

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

1. Colour gamut volume values were found more in sheet-fed offset printing press compared with the Piezoelectric inkjet printing press on uncoated, matte coated and gloss coated papers.
2. The values of colour gamut volume were found more on Gloss Coated paper as compared to the Uncoated and matte coated paper in both of the presses.

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