COLOUR OPTIMIZATION IN SHEET-FED OFFSET PRINTING PRESSES FOR PHARMACEUTICAL-BASED CARTON PRODUCTION

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ABSTRACT

The primary function of an image is its colour, and in the field of printing technology, the utmost importance lies in reproducing the original colour accurately during the printing process. Following printing, all printed materials undergo rigorous quality checks to determine their acceptability. One of the critical processes in this evaluation is the calibration of input and output devices during image rendering, which is referred to as "colour difference." Sometimes, variations in printed colours can be attributed to changes in the colour visuals. These discrepancies in colour or colour shifts result from inconsistencies in reproducing colours between the proof and the final print, as well as variations in different printing tasks. Various factors can contribute to these discrepancies in offset printing, particularly when using sheet materials. Objective of this paper is to study colour optimization techniques to be used in sheet-fed offset printing presses.

KEYWORDS: Delta E, Sheet Fed-Offset, Colour Difference, Colour Variation, Colour Optimization
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INTRODUCTION

The primary goal of the printing industry is to deliver high-quality work on time while ensuring customer satisfaction. It is crucial to maintain consistent print performance within a given job and across various tasks. Offset printing using sheet materials is a widely used process, especially in the packaging industry.

Colour is a fundamental element in printing. Colours are categorized based on human visual perception, including colours like red, blue, yellow, green, orange, and purple. Our perception of colour is the result of conical cells in the human eye being stimulated by electromagnetic radiation within the light spectrum. Colour categories and their physical characteristics are associated with objects based on the wavelength of light they reflect. This reflection is influenced by the object's physical properties, such as light absorption and emission spectra. Colours can be numerically represented using coordinates in a colour space. Discrepancies in colour during the printing process are a common issue in offset printing.

Colour spaces typically encompass three main components: hue, lightness, and saturation, which are used to describe colours. To establish a numerical method for calculating these three CIE (Commission Internationale de l'Eclairage) colour attributes, various studies have been conducted on human colour vision and perception. The CIE has established standards for colour spaces like "CIE XYZ," "Lab*," and "Luv*," allowing for comparisons of different colour spaces across various viewers and their

devices. These CIE standards are device-independent and do not rely on the visual skills of individual observers.

RESEARCH OBJECTIVES

Printing Compliance Colour with the standard is one of the most important aspects of printing, and if any discrepancy in the Colour found than all the output is rejected by the client. The purpose of this research project is:

1. To find out the various factors responsible for changing colours in sheet fed printing presses.
2. To analyse the degree of Colour variation in sheet-fed offset furnaces on various mono-cartons.
3. To suggest the best possible acceptable solutions to the Colour deviation problem in printed sheet printing systems

RESEARCH METHODOLOGY

The parameters set at this stage must be clearly observed in subsequent processes to achieve the planned object. The highlight of this section is Esko Work Flow. Equipped with a wide range of powerful tools, it is an integrated software package for packaging that provides the best design and graphic designs based on CAD with improved colour management and output control. Complementing EskoWorkFlow is the screen Dainippon Computer-to-Plate technology undisputedly one of the most revolutionary breakthroughs of our time, which enables direct plate exposing and simultaneously transfer of image profile to CPC console of the Offset machine. This not only gives the best quality crispy prints but ensures the same in severely crunched time. Excellent dot clarity and colour consistency for repeated job has become too easy. On other hand, in ink matching lab various tests are carried out like IGT, Roll-Up test etc

After that designed job is printed using SpeedmasterCD-74-6+L, and solid ink density is maintained using bench spectrophotometer available in Edelmann Packaging.

DATA COLLECTION AND ANALYSIS

Table.1. Colour Difference analyzed with the help of Spectrophotometer

	SAMPLE 1	SAMPLE2	SAMPLE 3
	CYAN	CYAN	CYAN
JOB 1	1.8	1.7	1.71
JOB 2	0.45	0.33	0.46
JOB 3	1.26	1.45	1.79
JOB 4	1.41	2	1
JOB 5	0.37	0.33	0.46

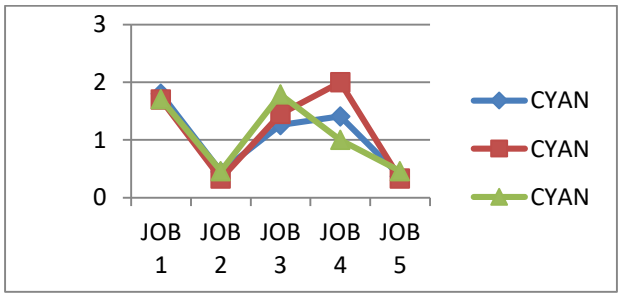

Fig.1. Comparative Analysis of ΔE by change in Lab values of Cyan at various sample

Table.2. Colour Difference analyzed with the help of Spectrophotometer of various Mono Cartons printed by Sheet-Fed Offset Printing Process

	SAMPLE 1	SAMPLE2	SAMPLE 3

	MAGENTA	MAGENTA	MAGENTA
JOB 1	2	0.96	0.45
JOB 2	0.37	0.3	0.45
JOB 3	0.98	0.92	0.46
JOB 4	1.71	2	1.7
JOB 5	0.37	0.3	0.45

Fig.2. Comparative Analysis of ΔEby change in Lab values of Magenta

Table.3. Colour Difference analyzed with the help of Spectrophotometer of various Mono Cartons printed by Sheet-Fed Offset Printing Process

	SAMPLE 1	SAMPLE2	SAMPLE 3
	YELLOW	YELLOW	YELLOW
JOB 1	1.5	1.3	0.64
JOB 2	1.43	1.45	1.41
JOB 3	0.63	0.91	1
JOB 4	1.72	2	1.7
JOB 5	1.52	1.31	0.64

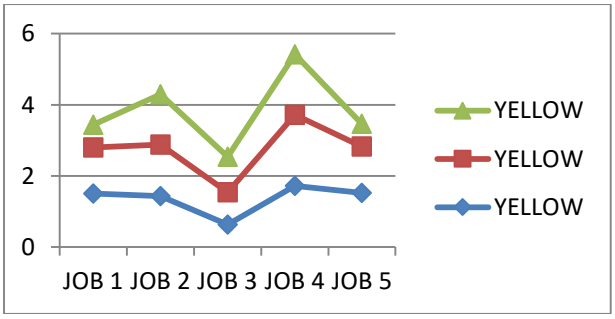

Fig.3. Comparative Analysis of ΔEby change in Lab values of Yellow at various samples

Table.4. Colour Difference analyzed with the help of Spectrophotometer of various Mono Cartons printed by Sheet-Fed Offset Printing Process

	SAMPLE 1	SAMPLE2	SAMPLE 3
	BLACK	BLACK	BLACK
JOB 1	0.12	0.35	0.2
JOB 2	2	1.7	2.03
JOB 3	0.12	0.55	0.35

JOB 4	0.13	0.32	0.16
JOB 5	2.1	1.77	0.54

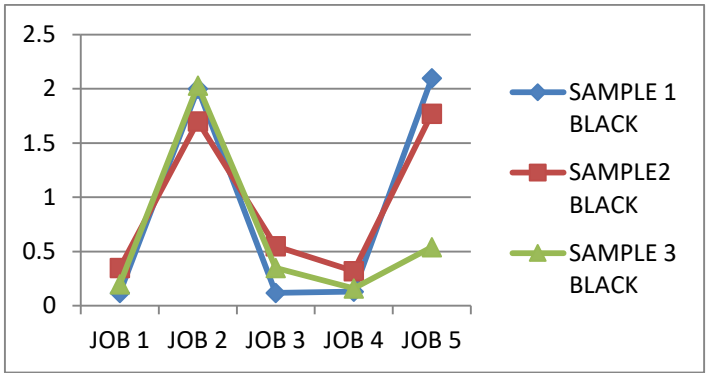

Fig.4. Comparative Analysis of ΔEby change in Lab values of Black at various sample.

RESULT AND DISCUSSION

Colour Difference during printing of Mono-Carton

Table 5 shows the Colour difference observed when printing different jobs using the frame-offset process. Three samples of each job were taken, and a total of 19 papers were found to calculate the Colour difference that occurs during printing. Three samples were taken from the initial stage, the middle stage and the end of printing , and then ΔE is calculated by measuring Lab values of the samples using a spectrophotometer available in Edelman Packaging. In the press room there is a bench spectrophotometer with integrated Intellitrax software that helps to maintain the solid ink density of inks to maintain the same Colour when printing jobs. After printing, ΔE is measured using an X-rite CH8105 spectrophotometer, and the ΔE value is measured using the Cie76 algorithm. A result of less than 2 is usually considered a susceptible equivalent.

Colour Variation observed while printing same job on different substrate but with same GSM and also with same press room condition

From various tables, the Colourchange is represented, for example, by printing the same work, but on another substrate, but with a fixed 350 GSM and all the conditions of the press room are maintained same. In this experiment, colour variation is observed. In this experiment, different types of paperboard are used. A substrate such as Gray Back, White Back, FBB, etc., is printed. The same substrate as the Gray Back, but with a different brand, also demonstrates the variation when they print the same work. This experiment is conducted to show that the substrate is an important factor in the Colour difference in the printing process.

Colour difference by change in layout of the job

From various tables, the colour difference is represented, for example by changing the layout of the job the colour difference is examined. This shows that layout of the job to be printed is also an important perspective in printing industry.

CONCLUSION

- Colour difference can be controlled during printing by maintaining solid ink density.
- Substrate is a variable in colour difference so care should be taken while printing that same brand substrate should be used while printing the same job.
- Change in page layout is a major cause of colour difference .

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