



ANALYSIS OF COLOUR DIFFERENCE (ΔE) IN SHEET-FED OFFSET PRINTING FOR RIGID PACKAGING APPLICATIONS

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ABSTRACT

Printing is a process of reproducing exact copy of an original. Nowadays, it becomes important to produce the copy with precision. There are various variables that are considered while printing to acquire exact colour. This paper deals with the experiment carried out in Edelmann Packaging India Pvt. Ltd., Baddi to find the extent of colour difference observed with change in substrate by keeping their GSM same. The pressroom conditions are also maintained at standards throughout this experiment.

KEYWORDS: Substrate, Colour Difference, ΔE , Colour Analysis, Sheet-fed Offset

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INTRODUCTION

Each image primary feature is colour and in printing technology the thing which is most important is reproducibility of original i.e. how exactly the colour of an image can be reproduced through printing process.

After printing all printed material are passed through various standards and checked whether the product is unacceptable limit or not. One of the most important processes is calibration of input, output device during image reproduction and its effectiveness can be termed as "colour difference".

Paper and paperboard are two substrates which are majorly used in printing and packaging industry by Offset printing press. In this research work paperboard is used as substrate.

RESEARCH OBJECTIVES

- To find out the variation of colour observed by using same substrate but of different brands, degree of variation observed by changing the type of paperboard but pressroom conditions

are same and same printing machine is used.

- To find out, if layout change can be a reason of colour difference observed while printing.

RESEARCH METHODOLOGY

There are two things that are considered under research methodology:-

- I. Material
- II. Methods

Materials: - Paperboard is used as substrate in this research but are of different varieties. Various types of paperboard were used to carried out this research work. Different substrates are used like - Grey backboard, White backboard, FBB, Carte Lumina, Superia Graphic but there GSM is fixed at 350. The substrates used are subcategorised by different brands. For Example- Grey backboard used of Companies like- N.R.A, Gayatri Shakti, DevPriya Products, Sidharth.

Ink: - Sigwerk ink was used during project work.

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Methods: -

Pre-press: - 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 Esko Workflow 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. 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

Press: -The jobs are printed by using Speed masterCD-74-6+L, and pressroom conditions are maintained at:-

- Temperature – $22^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Relative Humidity - $48\% \pm 5\%$
- Speed – 10,000 sheets/h
- Contact Pressure – 0.07mm
- Dampening Solution Chemistry
- Water Hardness - $10^{\circ} \pm 2^{\circ}\text{dH}$
- PH – 5 ± 0.3
- Temperature - $12^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Post-press: -In post-press section, the colour difference i.e., ΔE is calculated by measuring L,a,b values of the samples using a spectrophotometer (X-rite CH8105 spectrophotometer) available in Edelmann Packaging India Pvt. Ltd.

DATA COLLECTION AND ANALYSIS

Table 1 Colour Difference analysis during printing of Cyan colour

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	SAMPLE 1	SAMPLE2	SAMPLE 3	AVG. ΔE
JOB 1	1.65	1.08	1.56	1.41
JOB 2	6.91	6.86	6.61	6.25
JOB 3	3.58	5.12	5.49	4.85
JOB 4	2.33	3.82	4.85	3.38
JOB 5	2.93	1.2	3.7	2.79

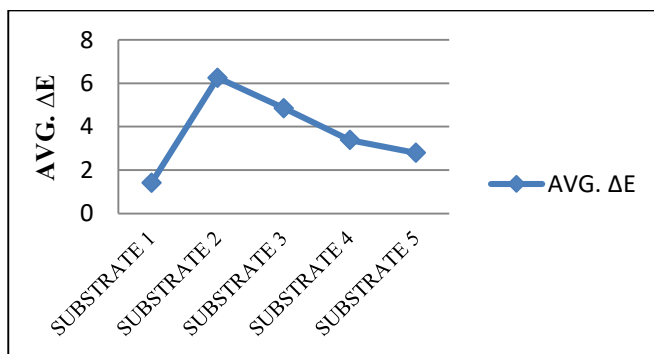


Fig.1. Comparative Analysis of Avg. ΔE of Cyan colour for various samples

Table 2 Colour Difference analysis during printing of Magenta colour

	SAMPLE 1	SAMPLE2	SAMPLE 3	AVG. ΔE
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JOB 1	0.83	2.04	1.44	1.43
JOB 2	1.79	3.88	2.97	2.89
JOB 3	2	2.41	0.3	1.7
JOB 4	1.36	1.37	1.51	1.22
JOB 5	3.46	2.94	4.81	4.21

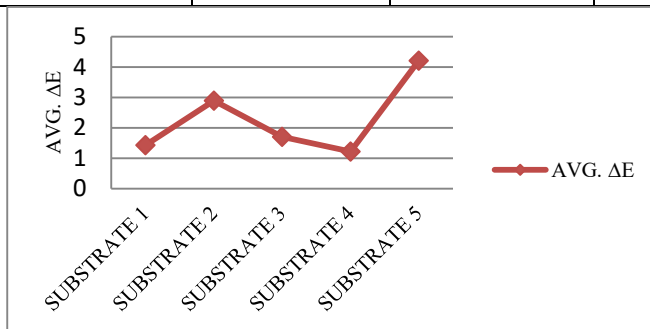


Fig.2. Comparative Analysis of Avg. ΔE of Magenta colour for various samples

Table 3 Colour Difference analysis during printing of Yellow colour

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	SAMPLE 1	SAMPLE2	SAMPLE 3	AVG. ΔE
JOB 1	2	1.41	0.71	1.12
JOB 2	4.21	4.24	4	4.14
JOB 3	5.19	3.31	4.69	4.75
JOB 4	2	1.41	2	2.69
JOB 5	3.26	6.4	4.89	5

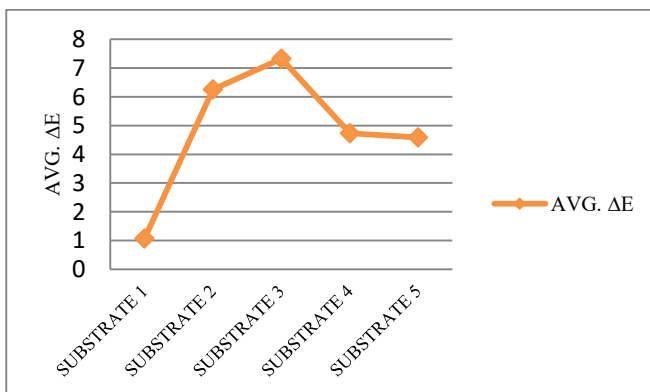


Fig.3. Comparative Analysis of Avg. ΔE of Yellow for various samples

Table 4 Colour Difference analysis during printing of Black colour

	SAMPLE 1	SAMPLE2	SAMPLE 3	AVG. ΔE
JOB 1	0.68	1.02	1.09	1.07
JOB 2	6.12	7.51	5.31	6.26
JOB 3	7.5	6.94	7.83	7.32
JOB 4	5.33	5.49	3.5	4.73
JOB 5	6.18	4.71	3.35	4.59



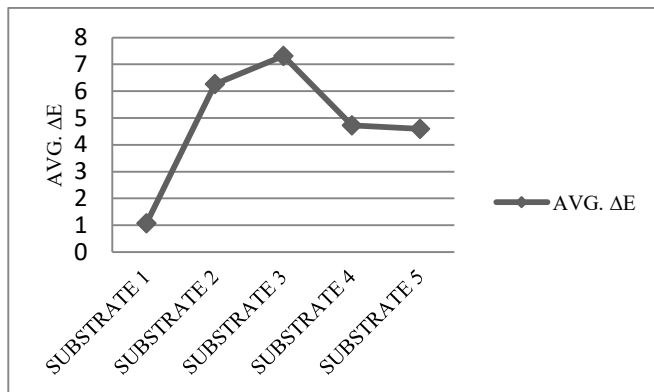


Fig.4. Comparative Analysis of Avg. ΔE of Blackfor various samples

RESULT AND DISCUSSION

1. Colour Variation observed due to change in substrate:

During the printing, same job was printed on different keeping the GSM constant with standard press room conditions. Various types of paperboard were used to carried out this research work. Different substrates are used like - Grey backboard, White backboard, FBB, Carte Lumina, Superia Graphic but there GSM is fixed at 350. The substrates used are subcategorised by different brands. For Example- Grey backboard used of Companies like- N.R.A, Gayatri Shakti, Dev Priya Products, Sidharth. After that all these substrates are printed with same Printing machine i.e., Speed master CD-74. The result obtained from this research shows that with change of substrate and substrate brand, a variation in colour is observed even if all press room conditions are maintained. These factors may lead ΔE to reach beyond standard limits.

2. Colour difference by change in layout of the job:

It is found that by changing the layout of the Job – M.D.H, a major value of colour difference is observed that is not acceptable. This shows that layout of the job to be printed is also an important perspective in printing industry to control colour deviation.

CONCLUSION

➤ Change in substrates may lead to colour difference change.

- The change in substrate and substrate brand may also lead ΔE to go beyond limits, so it is suggested to use same substrate brand for any particular job.
- The colour difference may also be caused due to change in layout and it is advised to follow the same layout for a particular job.
- The ink matching function at pre-press plays a vital role in improving the ΔE .

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