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Study of Print Quality on Different Substrates in Gravure Printing

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I. INTRODUCTION

Gravure printing is the fastest growing technology due to the quality it exhibits on the substrates. Although it is most suitable for long run jobs especially for packaging purposes. There are various factors which influence the print quality in gravure and some common factors are ink properties such as ink chemistry, viscosity, rheological behavior, solvent evaporation rate, and drying, etc, process parameters, such as doctor blade angle and doctor blade pressure, impression pressure, and printing speed have a tremendous effect on the quality of the printed ink film. The one major factor is the substrate properties which also effects on the print results. The substrates can be divided into two categories i.e. porous and non porous. The porous substrates includes various grades of paper whereas non porous includes various kind of films. The study includes analysis of print quality on substrates such as milky poly, polyester and BOPP while keeping the other process related parameter same throughout the printing. The printing on the stock is being done on a local gravure press.

Experimental Procedure
Materials & Methods:

1. An original or master is prepared having dot percentage 0%-100% with the interval of 3, 4,5 and 10% with longitudinal and circumferential placement along with color control patches, C, M, Y, K and registration marks in Corel draw 14.
2. Four gravure cylinders are prepared of master each for cyan, magenta, yellow and black ink.
3. Milky poly, BOPP and Polyester films are used as substrate.
4. India Ink is been used to print along with different chemicals.
5. Printing is done by conventional semi automatic gravure machine.
6. Density and dot gain reading is taken by X-RITE spectrodensitometer

II. GENERAL PROCEDURE

Printing work of this study is done in KWAlITY POLYMER Press, Hisar, Haryana on conventional semi automatic gravure press. at UNIQUE ROTO, Piragarhi, Delhi by conventional diffusion etch process. Cylinders are then placed in their proper position on the press. All the necessary adjustments are being done on the press. Doctor blade is set at an angle of 52degree. Ink is placed in the ink duct and its viscosity is checked after setting the web at infeed and outfeed unit. Pre-make-ready and make-ready operations were done on the machine.

Printing is done in substrate sequence of Polyester, Milky poly and then BOPP in color sequence- C, M, Y, K. Total 2kg of each film is being printed without changing the setting. The drying of the sheets is performed by totally evaporation and for this purpose heaters are set at Temp. 140 F.

The most critical setting was made to make proper registration to print four color jobs. Since after printing on first film the second film is made ready to print on and the registration setting on each film is required. The most perfect printing is achieved in the middle of the web and so the samples are taken from the middle to analyze.

Detection Method:

These printed test sheets are analyzed using X-Rite spectrodensitometer in university lab and at ICMC, Baddi (H.P.). The readings of dot gain and density is taken from three samples and their average is plotted on graph. These graphs are used to analyze and compare results. And results obtained from analysis of table and graphs prepared from different readings suggest that prints obtained on different substrates have value variation.

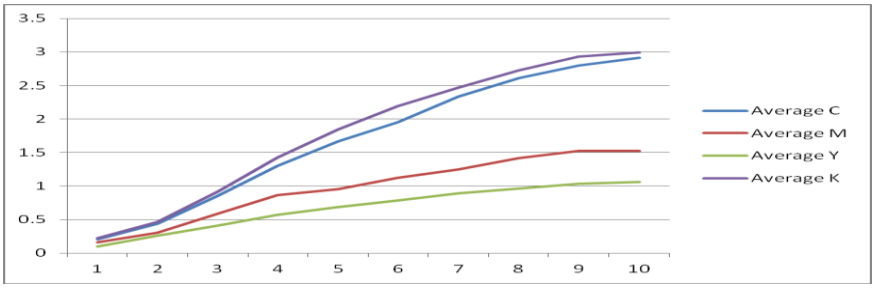
Data Collection and Analysis

After four colour gravure printing on three types of substrates i.e. Polyester, Milky poly and BOPP, best prints were selected for testing.

III. MEASUREMENT

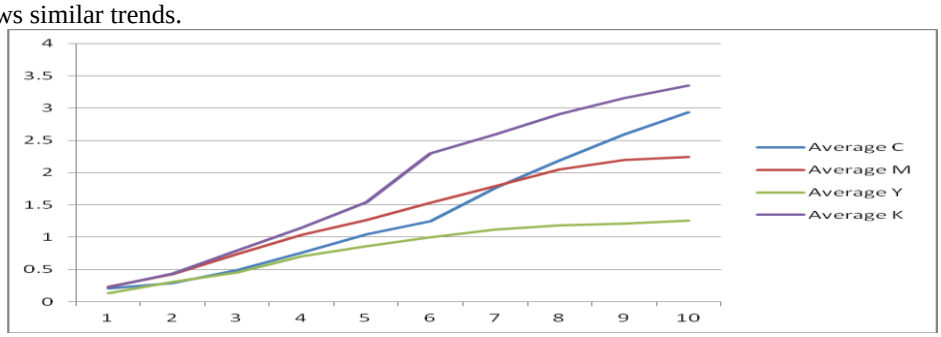
After selection of samples, various measurements were carried out and values of different parameters i.e. density and dot gain of all process colour C M Y K at 0 % - 100% Collected data were be analyzed to fulfill the research objective means to identify the print factors that gets affected in term of print quality on different substrates in rotogravure keeping the other related process parameters unchanged and analyze the final print quality. First analysis showed density comparison of C, M, Y, K from 0%-100% tint on Polyester, Milky poly and BOPP and second analysis showed dot gain comparison of C, M, Y, K from 0%-100% tint on Polyester, Milky poly and BOPP.

Density Comparison



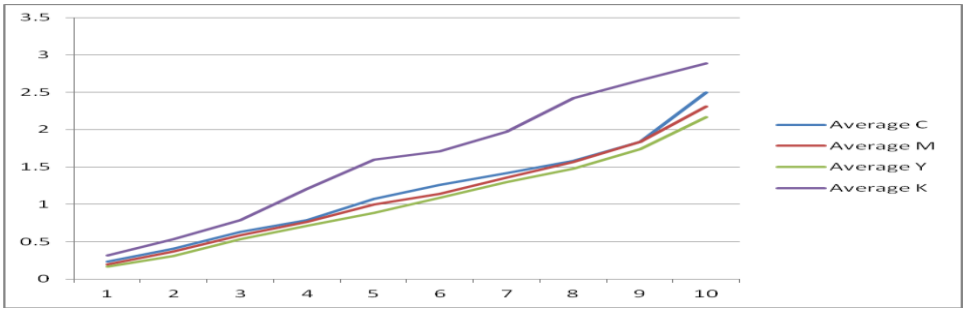
Graph 1 Density (Polyester)

It is clear from above graph that density of all process colour i.e. C, M, Y and K from 10 to 40 % tint patches shows similar trends.



Graph 2 Density (Milky poly)

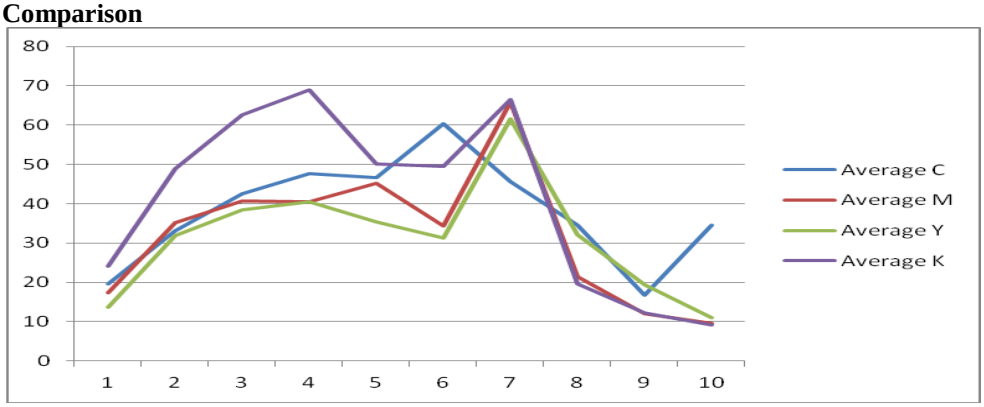
Above graph shows that density of all process colour i.e. C, M, Y and K from 10 to 40 % tint patches shows similar trends.



Graph 3 Density (BOPP)

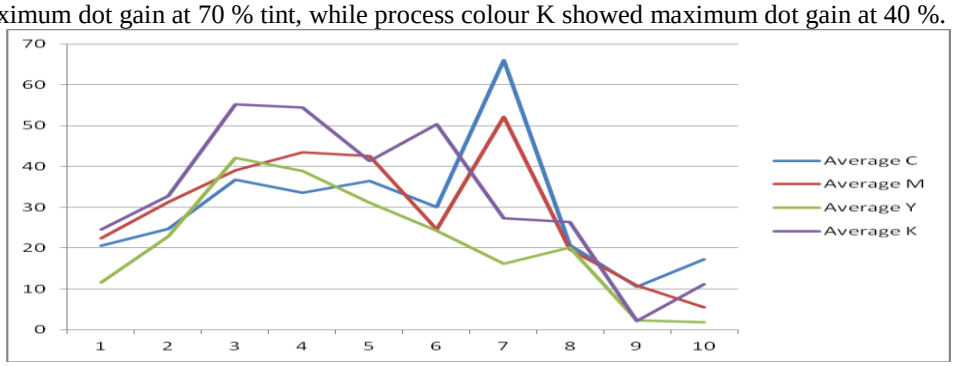
By analyzing the above graph, it is quite clear that all percentage levels of tint patches C, M and Y had almost same value with similar trend and K showed similar trend up to 30%.

Dot Gain Comparison



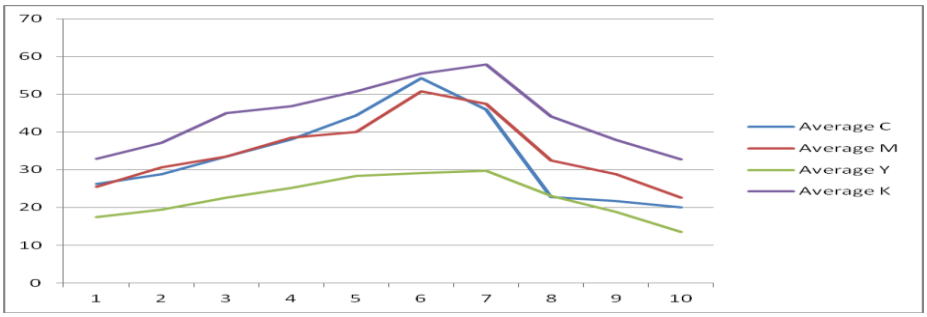
Graph 4 Dot Gain (Polyester)

Above graph shows that process colour C and M behaves almost similar at all tint- percentage level showed maximum dot gain at 70 % tint, while process colour K showed maximum dot gain at 40 %.



Graph 5 Dot Gain (Milky poly)

Above graph shows mixed results, process colour M and C showed similar trend of peak value of dot-gain at 70 % and on the another hand, process colour Y and K showed similar trend of peak value of dot-gain at 30 %



Graph 6 Dot Gain (BOPP)

It is quite clear from graph that all process colour C, M, Y and K showed almost similar trend all tint percentage level with different dot gain value. Process colour Y had least dot gain while Process colour K had maximum dot gain value.

IV. RESULTS AND DISCUSSIONS

By analyzing the data from Table 1 to 6 and Graph 1 to 6, it is quite clear that print quality factor i.e. ink density and dot gain values varies with substrate properties. All three substrates polyester, Milky poly and BOPP behave differentially in terms of ink density and dot-gain.

In highlight areas, trend of ink density values almost similar with lower ink density values achieved in case of BOPP. Middle-tone area and shadow tone areas also behaved differentially showed mixed results. BOPP showed unique result in terms of C, M and Y achieved almost same density level on the lower side and K on the higher side.

In case of dot–gain all three substrates behaved differentially for all process colour, polyester and milky poly showed peaks of dot gain values mostly at 40 % and 70 % tint patch with mixed performance of each process colour. In case of BOPP, all process colour C, M, Y and K almost behaved similar and showed peak result near about 70 % tint-patch.

V. CONCLUSION

- ✓ All three substrates achieved almost same density level on the lower side at highlight area's tint patches have little impact of substrate.
- ✓ Solid ink density for Process colour K almost same for all substrates.
- ✓ C, M and Y's solid ink density showed mixed result, higher for polyester and milkypoly substrates.
- ✓ C, M and Y's solid ink density showed almost same value in case of BOPP and need little bit control of process colour K's ink density.
- ✓ Solid ink density achieved for all process colour found in ascending order Y, M, C and K for all three substrates.
- ✓ Peak value of dot-gain almost all process colour found at 40% and 70 % tint patches.
- ✓ Polyester and Milky poly substrates showed mixed result for all process colour but substrate BOPP behaved uniquely with almost same trend of dot gain for all process colour.
- ✓ It is right to say among all substrates, BOPP showed good results in terms of good print quality.

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