Nokta Kazancı Problemi ve Kuru Ofset Baskıda Konik Şekilli İşler İçin Bu Problemin Çözümü
Problem Of Dot Gain And Its Solution In Dry Offset Printing For Conical Shape Job

Ambrish PANDEY

ABSTRACT

The present paper discusses about the problems of dot gain and its solution based on the study done on dry offset press for printing on taper surface of the conical object like cups made up of plastic substrates. The conical object is made parallel with the blanket cylinder with even pressure, but due to different circumferential speed and circumferential coverage. The image dots are printed / transferred differently at each circular line of the conical surface.

Therefore the whole circumferential area of the conical object/cup can be divided in to three main segments i.e., upper and bottom area with high dot gain and middle area with more dot gain which is totally different than any of the normal printing where cylinders are used to transfer the image on flat substrates or on cylindrical surface. The readings shown here in the graph reflects problem of high dot gain in the dry offset for conical jobs which makes balancing of extreme highlight and extreme shadow areas very difficult therefore the highlight end of the gray scale can be achieved with lighter ink flow and the mid tone to shadow range of the gray scale can run with slightly darker ink flow on separate plates of Black for dot gain control and quality print on conical cups.

Keywords: Dry offset, conical cup, taper surface, mandrel, dot gain.

1. INTRODUCTION

Dry offset uses features of the raised surface plate of letterpress and the rubber blanket of offset lithography. In this all the colors are transferred consecutively from raised plates onto a common impression blanket and then printed on the container in one pass.

The Dry offset Printing Machine is a normally nine color offset, sidewall decorator

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with on mandrel drying. Rigid containers enter into the printer from a pre-loader. The pre-loader loads the cups into the printer. The printer in turn uses a feeder to feed cups onto a mandrel. There are eight mandrels on a hub that is rotated by an eight station indexer. After feeding a cup onto the mandrel, the cup is indexed one station and another rigid containers is fed onto a mandrel and is held on mandrel by vacuum. When the cup reaches the twelve o’clock position it is flame treated to enhance adhesion of the ink to the rigid containers. At the three o’clock position the rigid containers are printed. At the six o’clock position the ink is cured on the rigid containers. At the seven thirty position the Rigid containers is discharged onto the discharge conveyor by releasing the vacuum.

After a subsequent transfer to the blanket and then on the container a 2-4 micron film thickness is obtained. Dry offset printing is used to decorate a diverse range of plastic containers like

- Dairy products tubs, cups and lids containing margarine, yogurt and cream, etc.
- Building trade products such as emulsion paint cans, rigid tubes etc.
- Cosmetics and toiletry tubes.
- Pharmaceutical containers and syringes.
- Polylaminate (a metal and plastic laminate) tubes for toothpaste and other similar products.
- Detergent, bleach and motor oil plastic bottles.

Polyethylene and polypropylene are non-polar polyolefin with an inert, low energy surface. It is necessary to alter their surface chemistry and create a thin, oxidized, micro roughened surface layer if appropriate ink adhesion is to be obtained. This is done by electric corona discharge for thin walled food containers, and gas flame treatment on heavier containers like bottles and paint cans. Polyethylene and polypropylene always need pretreatment before being printed with any type of dry offset ink. Polystyrene is not pretreated when printed with conventional inks because adhesion is easily obtained by attack of the ester solvents which dissolve the surface.

The mechanisms by which dry offset inks dries are evaporation of solvent, absorption of solvent and plasticizer, catalytic cross-linking, radiation UV curing. This has lead to the development of different types of dry offset ink formulation, each utilizing one drying method.

The actual drying methods used depends on the type and size of the container being printed. Infra-red predominates in food packaging, while hot air is used for non-food containers. Both use conventional inks but UV-curing inks have found increasing use in all areas.

For drying the printed tub/cup is rotated while being carried on a conveyer belt past a row of electrically heated ceramic panels which emit medium to long wave IR
radiation. The drying line is long up to 10 meters, and the tubs takes 15-20 seconds at 80-100°C to dry before being nested together and packed.

In second case the printed container is circulated in the basket or on its mandrel for 2-5 minutes at 80-100°C in fan assisted hot air oven. The drying speed is controlled by using high drying temperature more highly pigmented inks which can be printed at a lower film-weight.

In third case standard medium pressure mercury arc lamps are used arranged in one of two configurations i.e. curing on mandrel (COM), or off-line tunnel oven. With COM the UV lamps are fitted around the mandrel immediately after the print stations housed inside the printing machine.

The other arrangements feeds container on the conveyer belt through a tunnel oven of 2-3 meters in length containing two diagonally opposed UV lamps. The containers are not rotated at a uniform exposure is achieved by the highly reflective, polished interior.

In case of printing of conical shape hollow object like long and short cups on dry offset, the main reason of dot gain and its variation in different area of object to be printed is due to different circumferential speed of object mounted on mandrel and difference between the area of image on blanket and on the print. Apart from this the dot gain is also affected by the substrate of object, nature of photo polymer plate and unparallel positioning of printing hood of dry offset printing machine. This paper presents the result of dot gain at different positions of the plastic cups printed on dry offset.

2. MATERIALS AND METHODS

This study is carried out during the dry offset training at Sanden, North America, Kansas center for pre-press and print training on dry offset printing machine Master Color II of Minor Technologies and using X Rite Spectrodensitometer 500 series with Zeller Gmelin UV ink, for carrying this study a standard plate having the various dot percentage 0% - 100% with the interval of 2,3,5 and 10% for the highlight, middle and shadow dots was prepared at 120 line screen, for the best and detail results the printing of samples were planned in three different conditions first, maximum pressure and maximum ink run, second, minimum pressure and medium ink run and third, minimum pressure and minimum ink run.

The feeder belt set properly as per the job size the feeder timings, rotation of cups in front of flamers and exposes to U.V. lamps was also set accurately for the proper rotation of cups at the time of image transfer the shafts of the mandrels was chosen of appropriate size and the bearings of mandrel were replaced by new one and the mandrels with nearly zero deviations were set for smooth impression with the help
of dial gauge.

Form roller pressure were set with 1/8 inch stripe on the bearer line and across the image areas of the plate. Ink fountains were filled and checked for plate match and ink flow was set to minimum. Blanket pressure was set by disengaging plate cylinder to the “off” or “no print” position and plate pressure decreased until there is no image printing on the blanket and than slowly plate pressure added until the entire image get printed on all blankets for minimum pressure setting.

All blankets checked for even thickness and ensured that they do not have variance of ± 0.0005 inch between all blankets and mounted first bottom blanket, using the edge of the blanket cylinder as a guide to keep blanket straight and top blankets separately.

The printing hood of machine was set exactly following the centerline of the print, mandrel and blanket. The most critical setting was made to make taper mandrel with mounted cup making parallel with blanket cylinder for even transfer of ink film on each and every point on the cup. The black ink was used for the job and a selected stock of cups was reserved for the test prints and results obtained from analysis of table & graphs prepared from different readings are suggested for minimizing and compensating the dot gain problem related with such jobs in dry offset printing.

3. RESULT & DISCUSSIONS

A. Effect of Acetone and IPA on different blankets

To observe the effect of acetone and IPA on different blankets the three types of blankets were taken and put in both chemicals one by one after taking the thickness measurement for two minutes and thickness were measured after that the results are shown in following table.

<table>
<thead>
<tr>
<th>Readings (in inches) without chemicals</th>
<th>I Blanket</th>
<th>II Blanket</th>
<th>III Blanket</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0835</td>
<td>0.086</td>
<td>0.0865</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Readings after putting it in chemicals for two minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
</tr>
<tr>
<td>0.0995</td>
</tr>
</tbody>
</table>
This bar chart shows that use of IPA on all kind of blankets are preferable for better quality and leads to overall less dot gain in the print, therefore only IPA was used during the test printing.

**B. Dot Gain in Uppar, middle and bottom area of cup**

Dot gain on the rigid taper container can be seen over all very high and variably on the top, middle and bottom portions as recorded in the following table.

<table>
<thead>
<tr>
<th>Actual dot %</th>
<th>Maximum pressure and maximum ink run</th>
<th>Minimum pressure and medium ink run</th>
<th>Minimum pressure and minimum ink run</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dot gain Top Portion</td>
<td>Dot gain Middle Portion</td>
<td>Dot gain Bottom Portion</td>
</tr>
<tr>
<td>2</td>
<td>51</td>
<td>37</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>52</td>
<td>42</td>
<td>58</td>
</tr>
<tr>
<td>10</td>
<td>63</td>
<td>45</td>
<td>64</td>
</tr>
<tr>
<td>20</td>
<td>76</td>
<td>58</td>
<td>81</td>
</tr>
<tr>
<td>30</td>
<td>94</td>
<td>73</td>
<td>SOLID</td>
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<tr>
<td>40</td>
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<td>50</td>
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<td>80</td>
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<tr>
<td>90</td>
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<tr>
<td>95</td>
<td>SOLID</td>
<td>SOLID</td>
<td>SOLID</td>
</tr>
<tr>
<td>100</td>
<td>SOLID</td>
<td>SOLID</td>
<td>SOLID</td>
</tr>
</tbody>
</table>
**Figure 1. Maximum pressure and maximum ink run**

**Figure 2. Minimum pressure and medium ink run**

**Figure 3. Minimum pressure and minimum ink run**
After analyzing the all three graphs it is observed that
1. The dot gain is very high in top and bottom areas of the cup.
2. The dot gain is high in middle portion of cup in first two cases.
3. The dot loss in the middle portion in case of minimum pressure and minimum ink flow and close to ideal in top and bottom portions.
4. Minimum pressure and little more than minimum ink flow is the key for obtaining best possible results for printing on cups by dry offset. Which also saves the cost of excesses ink and increases the plate run along with quality.
5. In third case which is more suitable the dot gain problem of shadow areas and highlight areas can be compensated up to some extent by using highlight and shadow blacks separately.

4. CONCLUSION

The conical object is made parallel with the blanket cylinder with even pressure, but due to different circumferential speed and circumferential coverage. The image dots are printed / transferred differently at each circular line of the conical surface. Therefore, the whole circumferential area of the conical object/cup can be divided into three main segments i.e., upper and bottom area with high dot gain and middle area with more dot gain which is totally different and difficult situation than any of the normal printing where cylinders are used to transfer the image on flat substrates or on cylindrical surface. The readings shown here in the table and graph reflects the problem and suggests the solution of high dot gain in the dry offset printing for conical jobs with minimum pressure and minimum ink run. The balancing of extreme highlight and extreme shadow areas very difficult therefore the two circles made in the last graph indicating the division of half tones in two different films / plates for highlight black and highlight shadow. With the help of this for printing any photograph the highlight end of the gray scale can be achieved with lighter
ink flow and the mid tone to shadow range of the gray scale can run with slightly darker ink flow on separate plates for dot gain control and quality print on conical cups.

5. ACKNOWLEDGEMENT

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