



Various Types of Print Mottles in Sheet Fed Offset Presses; Possible Causes and Solutions from Printing Industry Prospective

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Abstract

The biggest factor affecting how print is used now is how the internet and mobile technology are transforming how people and organisations interact and access information. Even though its market share is declining, sheet fed offset presses have recently increased their base in the short run and package printing segments, proving they are a mature business that can withstand the challenges and risks brought by digital printing. One of the issues that have a more significant impact on the final print quality is print mottling. Photographs must be printed consistently and with good clarity from the first print to the last. This study examined several print mottling. Mottle once it is taken care will certainly reduce the possibilities of faulty print and increases the chances of high-quality print output.

Keywords: Offset press, mottle, back trap mottle, print mottle, water interference mottle, ink trap mottle, consistency, uncoated paper, gloss coated paper, matt coated paper

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Introduction

Offset printing method is one of the prominent methods of printing technique all over the globe. It works on the three-cylinder principle; plate, blanket and impression cylinders. Plate cylinder essentially holds the plate or image carrier to be used for print production, blanket cylinder to hold a soft & resilient rubber surface and the impression cylinder to hold the substrate to be used for printing. The inked image is first transferred from the plate to the blanket and then from the surface of the blanket to the substrate (Persistence, 2017).

In the offset printing, both the image and non-image areas lie on the same level, unlike the letterpress/flexographic/gravure printing, where both the areas are separately physically. The image areas are purposefully made to receive oil-based ink and hence they are oleophilic, at the same time, non-image areas accept fountain solution which is hydrophilic and oleophobic, this is the chemical separation method for the image and non-image regions, which are on the same surface plane. (Kipphan, 2001). In the recent times, emergence of internet and other digital media have created a potential threat to the traditional forms of printing for its survival, growth and development. It is the need of the hour to innovate and adopt technological advancements, so that offset printing can withstand possible threats posed by other media. Job changeover time and other operational features have been added to make this segment more progressive (Smithers, 2019)

Coated papers are generally suited to print high quality multi-colour printing operations, because such papers offer higher brightness, whiteness, gloss and opacity, which ultimately affects the final print quality. The other side of

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the coated paper is that it is highly contributes to number of print defects like; ink set-off, ink lay-off, mottling and picking related factors, while comparing the same with the un-coated paper stock. Printing mottle is one of the serious issues, especially in offset printing and hence needs utmost care and attention. Sometimes, print mottle results into whole print job consignment rejection, hence it has to be avoided suitably(Lee et al. 2021).

When printing on a sheet fed offset press, one of the print quality problems that require urgent attention is print mottling. There are different types of mottles and each one of them, needs different approach to reduce its effect during printing (Sandreuter 1994). Coating of the paper is very important when analysing the mottle. Uneven coating, during the coating step during the paper manufacturing process, alters the surface characteristics; opacity and brightness. Uneven paper surface leads to number of problems and mottling are one such aspect, to be taken into consideration (Anttila et al. 2009).

It is customary to discuss the many types of mottle that might appear during printing operation in offset press. Paper surface characteristics including smoothness and evenness of the paper surface of coated and un-coated paper plays an important role in this respect (Klein et al. 2011 a, b). Although, there are number of print mottles being seen in a offset press, they essentially contributes to the reduction of final print quality. Care must be given to find suitable solutions to the print mottle. Each type of print mottle behaves differently and hence different solutions to be employed to take care of particular mottle. Ultimate aim of any printing process is to produce print output with lowest level of printing defects, so that uniformity of printing can be maintained(Anayath, R. et al.).

Review of literature

As per, (Persistence, 2017), there are certain factors which makes the offset printing as one of the preferred methods of printing all over the globe. There is a wide choice of printing
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substrates, press chemicals, printing plates and working systems, that can be combined to suit to the particular need and requirement. Moreover, it is a mature industry and most of the technological advancements are successfully absorbed by this particular printing system, since its inception. Offset is known for consistent image reproducibility characteristics coupled with cost benefit that suits to different print run lengths.

Author (Kipphan, 2001) points out that, offset printing process is highly unique in many respects; it combines both the physical and chemical interface. The emulsification of ink and water is the point to look into for effective balance of the technique and the final printing. Minimum ink and water feed is the basic requirement and the press operator should focus on finding the right balance of these two so that the final print can be of utmost quality.

As per, (IGT, 2012), mottling is related to uneven or patchy look especially in solid areas and this makes the print look uneven. This is mainly due to improper balancing of ink, water, paper surface and press settings. Sometimes, colour sequence of the different colours to be printed, ink and its characteristics, composition of ink, rheological properties of ink, characteristics of the fountain solution, behaviour of blanket and most prominently the surface properties of the paper to be printed affects mottling, its source of occurrence and types of mottling.

Anayath R. et al., mention that, mottle is resulted by the mis-configured offset printing press, which leads to transfer and depositing uneven and more scientifically inconsistent ink layer onto the paper surface. Insufficient printing pressure, due to improper contact pressure between the plate and blanket cylinder, feeding excess amount of ink may contributes to higher amount of mottle and hence needs special care and attention.

Research objective

The purpose of any printing process is to prepare and produce consistent print output throughout the whole print run, which is the first and only requirement of the prospective

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print buyers or end-users. But at the same, even though it looks easy, but utmost care and attention is required to achieve consistent print successively. Though, there are number of print quality factors needs to be acted upon, one of the quality factors, print mottle, demands higher attention. Sheet fed offset printing, whose industrial applications started from 1960's, is widely used because of numerous advantages and wider applications in the printing arena.

The basic objective of the research is to identify various mottles that generally occurred in a typical multi-colour sheet fed offset press, their causes of occurrences and possible solutions of such mottles. This will certainly help the offset printers to act promptly, especially when such problems occur and taking such situations in order to produce error free print output in a typical offset press organization.

Research Methodology

Basis weight, thickness, brightness, CIE whiteness, yellowness, opacity, L*, a*, b*,

gloss, tensile index, rip factor, burst factor, roughness, porosity, and Cobb are just a few of the paper characteristics taken into consideration. The paper samples were chosen from the four distinct brands of uncoated, gloss coated, and matt coated paper that had test results that were near to the norms specified in ISO 12647-2. The paper selected was of 110 gsm, uncoated, gloss coated and matt coated stocks. Various print mottle was tested with the IGT, W: 57, 58, 59 & 92 PRINT MOTTLE, mottle was evaluated, which were analysed for the various causes and possible solutions of such mottles.

DataCollection & Analysis

In back trap mottle the selected papers were printed and the ink of the printed strip is set off 4 times to 4 clean printing discs with interval times, with the W 57. The result of the test is presented in table 1. It shows, in case of un-coated paper, mottle is seen on both the sides of the paper, whereas on the gloss coated and matt coated papers, mottle is not observed.

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Table 1, Print mottle (IGT W: 57)

	Side A	Side B
Un-coated paper	mottle seen	mottle seen
Gloss coated paper	mottle not seen	mottle not seen
Matt coated paper	mottle not seen	mottle not seen

A substrate strip is printed 4 times with the same printing disc, with the W 58, in print mottle. The result of the test is presented in table 2. It shows, in case of un-coated paper,

mottle is seen on both side substrates, whereas on the gloss coated and matt coated papers, mottle is not observed.

Table 2, Print mottle (IGT W: 58)

	Side A	Side B
Un-coated paper	mottle seen	mottle seen
Gloss coated paper	mottle not seen	mottle not seen
Matt coated paper	mottle not seen	mottle not seen

Water disruption Mottle is the uneven printing outcome brought on by the paper's inadequate and uneven water absorption, followed by the W 59's uneven ink absorption.

Table 3 displays the examination's results. It demonstrates that while mottle is not visible on the gloss coated or matt coated papers, it is present on uncoated paper on both sides.

Table 3, Print mottle (IGT W: 59)

	Side A	Side B
Un-coated paper	mottle seen	mottle seen
Gloss coated paper	mottle not seen	mottle not seen
Matt coated paper	mottle not seen	mottle not seen

Ink trap mottle, also known as uneven ink absorption in paper, is the uneven printing outcome brought on by a trapping in tack and/or viscosity of the ink in wet-on-wet printing. It is also impacted by the W 92. Table

3 displays the examination's results. It demonstrates that while mottle is not visible on the gloss coated or matt coated papers, it is present on uncoated paper on both sides.

Table 4, Print mottle (IGT W: 92)

	Side A	Side B
Un-coated paper	mottle seen	mottle seen
Gloss coated paper	mottle not seen	mottle not seen
Matt coated paper	mottle not seen	mottle not seen

Result & Discussion

There are basically four types of mottles, which are encountered in a offset press during the print production cycle. IGT tester, which is considered as one of the very useful testing equipment for the Graphic Arts industry is very successfully used to measure the all the four types of mottles and the table1, 2, 3 and 4 represents all the mottles that can be seen while printing on various grades of paper; un-coated, gloss coated and matt coated stocks.

It is clearly observed that, un-coated papers, due to its roughness and uneven surface characteristics, especially while printing in offset presses, where ink and fountain solution plays a very crucial role, results into mottles. All the four types of mottles, may come to picture in a typical offset press, when using un-coated paper for printing. Un-coated papers are generally sized or glazed with series of hot/cold roller pressing during the paper manufacturing to take care of surface smoothness. The degree of sizing or pressing will certainly control the occurrence of mottle, while printing on these papers.

In case of coated paper, the surface roughness and irregularities are generally sealed with a layer of coating on the base paper surface, this essentially helps to reduce the possibilities of mottles during printing in atypical sheet fed offset press. It is quite likely that potential mottling in sheet fed offset presses may be dealt with the right caution, focus, and careful balance of ink-water and press setting. When using uncoated paper for

printing, attention must be given to ensure that the paper's surface is smooth and that it was manufactured to the correct size. This will reduce mottle when printing on the same stock.

Conclusion

The market share of sheet fed offset press, even though getting reduced, but in recent times, it has enlarged its base for short run and packaging printing segment, which clearly indicates being a mature industry it is able to absorb the market shock and threats posed by digital printing. Among the various printing quality factors, print mottle needs special care and attention, so that the printer is able to print consistent and high-quality print output to the print buyers and print users. With uncoated papers, special care must be observed, towards the surface characteristics, so as to minimize the chances of mottles and for uncoated papers; both gloss and matt coated, even though, there is a little chance of mottle, still the cylinder pressure setting, the ink and fountain solution characteristics and their interaction in the press must be taken into account for possible solution of mottle in sheet fed offset press.

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