

Study of Print Mottle in Sheet-Fed Offset Printing

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Abstract

One of the unpleasant effects is the unintentional spatial reflectance variations in the print commonly known as print mottling. But the quality of a print would always have been the key concern for every printer. The variation in quality of printing due to numerous reasons causes such unpleasant effect during printing. In order to troubleshoot this problem this research work was done. During research the various printing variables were taken into consideration. The key objective of this paper is to identify the type of print mottle which mostly occurs and its causes of occurrence in sheet-fed offset printing.

Keywords: Print Quality, Offset Printing, Reflectance, Mottling, Print Variables

Introduction

Offset printing is a planography printing process. The principle of sheet-fed offset printing process is derived from the planography printing process. As the word planography conveys the meaning that the printing and non-printing area lie in the same plane, similarly sheet-fed offset printing process consists of both the plane i.e. printing and non-printing area in the same plane. Planographic printing process is generally a process in which we separate image and non image area chemically with the use of certain chemicals in such a way that image area is ink receptive and non-image area is water receptive. This process is based on the fact that oil and water repulse and don't mix each other. The transfer of ink from one image area of the plane is controlled by maintaining the balance of water and ink. The printing unit of the offset press basically contains three cylinders: a plate cylinder, a blanket cylinder and an impression cylinder. The plate is attached to the plate cylinder and the blanket is attached to the blanket cylinder. The impression cylinder carries the paper through the printing unit. It provides a support against which the blanket can impress an image on the paper. The paper is then transferred to the delivery tray. The desired print image is exposed onto a plate which is transferred from the plate to a rubber blanket and then subsequently to the printing substrate with the help of sufficient impression pressure, therefore offset is also called indirect process of printing.

In offset printing, print mottle is caused due to irregular back trap of ink which happens due to irregular rate of drying. Ink and water uneven balance is major reason for various type of mottling. It also occurs due to non uniform absorption of fountain solution on the surface of paper. Print mottling is basically a non uniform appearance of paper surface with sufficient ink covering. The print mottle does not occur not only in the solid printing but it appears on the half tone dots also. Some more reasons include other than those related to ink transfer. Print mottle can occur on almost all types of printing surfaces i.e. porous as well as non porous surfaces. Print mottle can occur in different printing processes but the way it occurs varies.

Objectives of Study

In the modern age of science and technology, the recent scientific innovations have given rise to various technologies in each and every aspect of life including print sector also. Despite of the widening use of modern technology in the print sector, the sheet-fed offset printing still faces the various problems during printing. Print mottling is one among them and printers have to cope up it as soon as possible to maintain the quality up to the mark. Therefore key objectives of this research are to delineate the following aspects of print mottling in Sheet-fed Offset printing: -

- i. Various types of Print Mottle in Sheet-fed Offset Printing
- ii. Identification of various causes of different types of print mottling
- iii. Remedies to overcome different types of print mottling

Research Methodology

This research work was carried in order to analyze the print mottling in sheet-fed offset printing. The whole research was based on observation and identification of mottle defects occurred during printing. Magnifying glass helps in identifying the type of print mottle defect occurred. Various jobs printed by sheet-fed offset printing were analyzed on observation bases by using a magnifying glass in order to accomplish the research effectively. The difference of print mottle level between various jobs was observed on the bases of perceptive evaluation by several standard observers. A Munsell cell test was conducted on the observers. Those who passed the test were considered as the standard observer.

Data Analysis

The data was collected during research. The data so collected was compiled and analyzed in order to accomplish the research effectively. By using this statistical data, the interpreted results were expressed in graph and figure. The following aspects were taken into consideration during analysis:-

1. Various types of Print Mottle in Sheet-fed Offset Printing
2. Identification of various causes of different types of print mottling
3. Remedies to overcome different types of print mottling

The findings of research are presented and illustrated as below:-

1. **Various types of Print Mottle in Sheet-fed Offset Printing:** - Depending upon the nature of printing process i.e. principle of offset printing process and on the bases of the observation during the research the various types of print mottles were predictable. On the bases of data collection it was found that maximum frequency of occurrence was recorded for Printer's mottle followed by Water Interface mottle. Moreover the Back Trap mottle ranked third place followed by Ink Trap mottle. The plain Paper mottle did not occur at all. Because this type of mottle occurs due to unique paper characteristics but paper used during the research was of the same grade and quality. The results of the data collected during the research are depicted in fig.1.

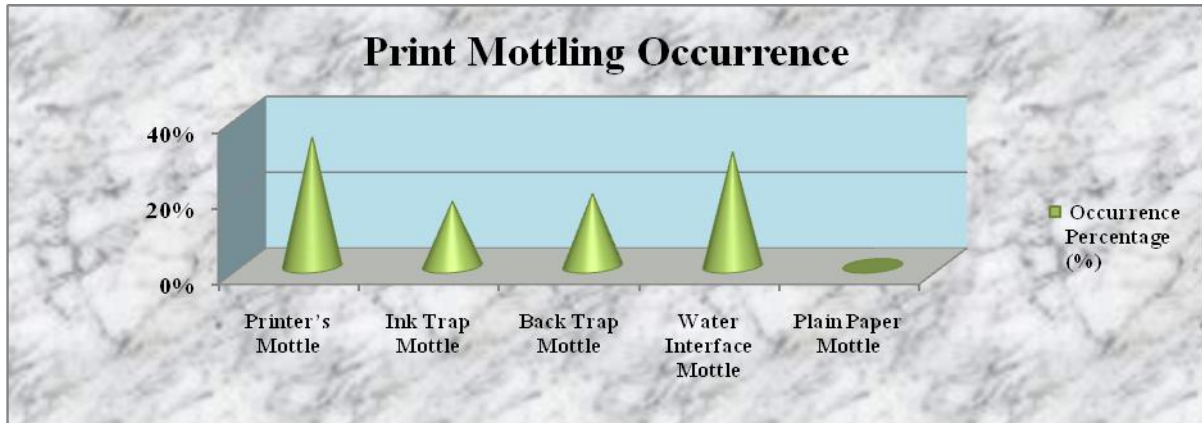


Fig. 1: - Types of print mottling occurrence in Sheet-fed Offset Printing

During observation it was found that the maximum frequency recorded for the occurrence was 34% i.e. printer's mottle. In addition to this there is 30% probability of water interface mottling occurrence. On the other hand ink trap mottling frequency was found minimum i.e. 17%. On the bases of observation during the research, different types of print mottle identified were: -

- a. Printer's Mottle
- b. Water Interface Mottle
- c. Ink Trap Mottle
- d. Back Trap Mottle
- e. Plain Paper Mottle

2. Identification of various causes of different types of print mottling: - During offset printing it was found that various causes were responsible for the different types of print mottling. These numerous causes for the different type of print mottling in offset printing are elucidated as below:-

A. Printer's Mottle: - Printer's mottle often occurs due to the misconfiguration of the press with non uniform ink film on the paper. The various causes for printer's mottle found are shown in figure 2.

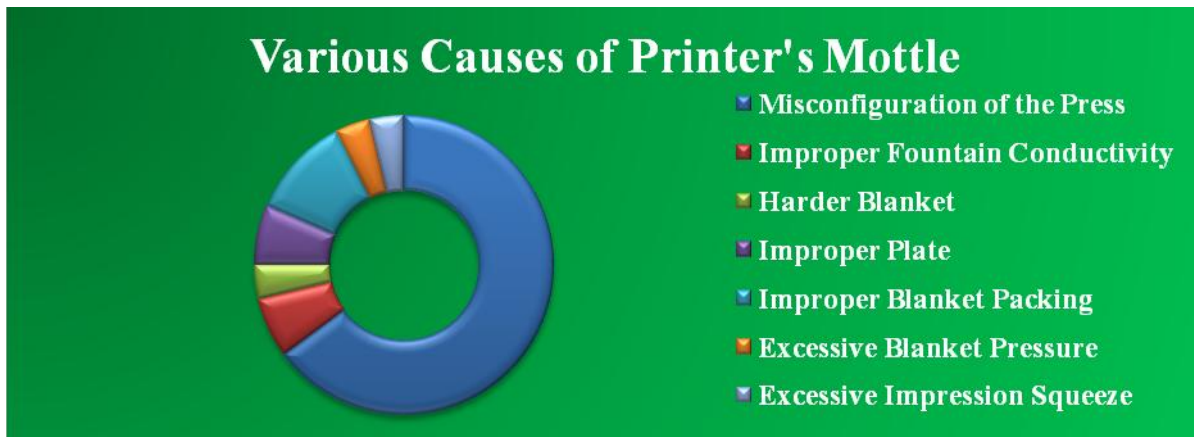


Fig. 2:- Various causes of occurrence of Printer's Mottle

The results of the observations delineated that the major reason for printer’s mottling occurrence was misconfiguration of the machine during printing. Due to this 70% mottling results occurred while another causes were improper blanket used, improper fountain solution and harder blanket in sheet-fed offset machine during printing.

B. Water Interface Mottle: - When paper absorbs fountain solution unevenly ink applied in the subsequent units lay unevenly. This ink and water imbalance results in the blur or low dot structure during printing. This result is known as water interference mottle.

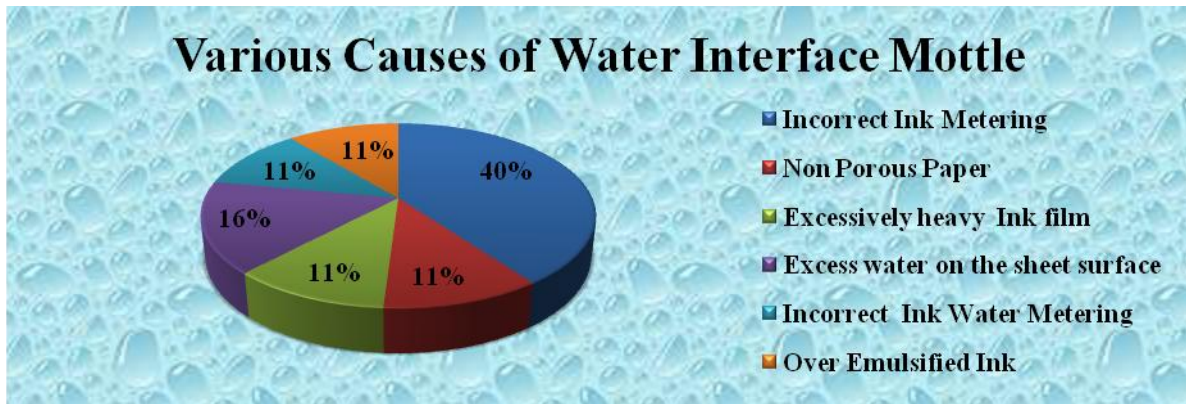


Fig. 3:- Various causes of occurrence of Water Interface Mottle

The results of the data collected are expressed in fig. 3. During research it was observed that the main reason behind water interface mottling was the result of ink and water imbalance on to the substrate during printing. The main reason that contributed 40% of water interface mottling occurrence was incorrect ink metering. While 16% probability of excess water occurrence on the sheet surface during water interface mottling. In addition to this non porous paper, excessively heavy ink film, incorrect ink-water metering and over emulsified ink also contribute to some extent i.e. 11% of each.

C. Ink Trap Mottle: - During multicolour printing when paper passes from unit to unit, poor or inconsistent ink trap transfers non uniform ink film on previous printed ink film on the substrate resulting in Ink Trap Mottle.

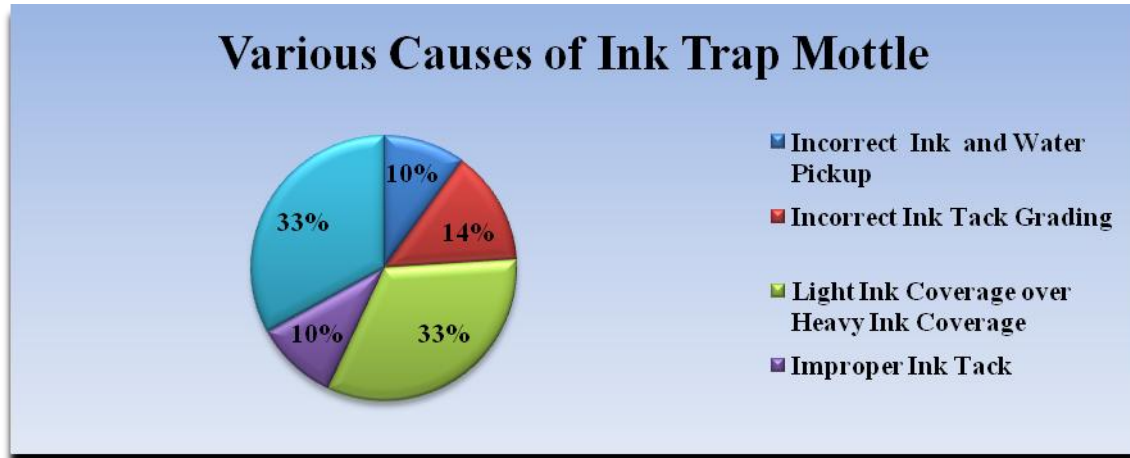


Fig. 4:- Various causes of occurrence of Ink Trap Mottle

The result presented in fig. 4 depicted that Ink Trap mottling is the consequence of both insufficient ink tackiness and light ink coverage print over heavy ink coverage contributing 33% each. Another key factor includes incorrect ink-water pick up, incorrect grading of ink tack and improper ink tack contributing 10%, 14% and 10 % respectively.

D. Back Trap Mottle: - When the printed sheet travels from one unit to another, the ink film on the paper surface traps back non-uniformly onto subsequent blankets doing uneven ink transfer and absorption on the paper surface. This defect is known as back trap mottling. The results of the observations of back trap mottling are presented in fig. 5.

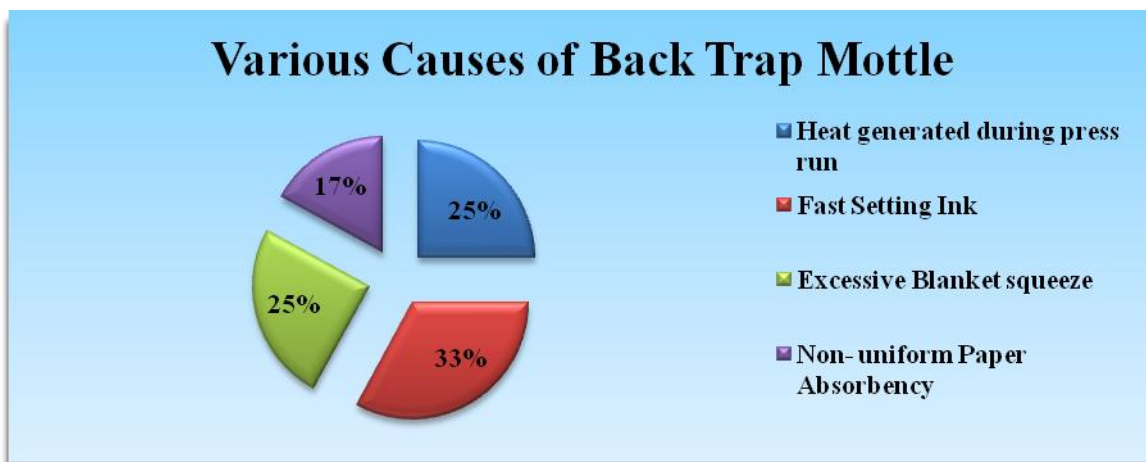


Fig. 5:- Various causes of occurrence of Back Trap Mottle

The result presented that back trap mottling have maximum probability of 33% when we use fast setting ink during offset printing. It was also the consequence of excessive blanket squeeze, non uniform paper absorbency and heat generation 33% due to long press run having probability of 25%, 17% and 25% respectively.

3. Remedies to overcome different types of print mottling: - It is inevitable to overcome these various mottle from quality aspect of printing. So following remedies are suggested in context to observation during the study. These are : -

SHEET-FED OFFSET PRINTING			
Various Mottling		Mottling Remedies i.e. How to Overcome	
Sr.	Type of Mottling	Causes (If it is:)	Then (Action)
1.	Printer's Mottle	Misconfiguration of the press	Configure the press properly
		Improper fountain conductivity	Control fountain conductivity
		Improper plate	Check the plate and correct it
		Improper blanket packing	Setting the blanket packing
2.	Water Interface	Excessive impression squeeze	Reduce the impression squeeze
		Incorrect Ink and Water Metering	Setting inking - dampening unit
		Over Emulsified Ink	Add reducers to the ink
		Excessively heavy Ink film	Setting the inking rollers
3.	Ink Trap Mottle	Excess water on the sheet surface	Setting dampening system
		Incorrect Ink Metering	Setting inking system
		Ink tack not enough	Add the ink thickening agents
		Incorrect ink water pickup	Correct ink water pickup
4.	Back Trap Mottle	Improper ink tack	Maintain ink tack
		Heat generated during press run	Installation the exhaust fan
		Excessive Blanket squeeze	Reduce the blanket squeeze

Results and Discussion

After collecting the data, it was analyzed. It was observed that the results obtained during the research were in accordance with the standard range. During the analysis of the data it was observed that the most frequently occurring printing defect is print mottling. Various types of print mottling were found during the research. The frequency of different types of mottling in Sheet-fed Offset Printing is summarized in table 1 as below: -

SHEET-FED OFFSET PRINTING	
Type of Print Mottling	Percentage of Occurrence
Printer's Mottle	34%
Water Interface Mottle	30%
Ink Trap Mottle	17%
Back Trap Mottle	19%

Table 1: - Summery of print mottling occurrence in Sheet-fed Offset Printing

Conclusion

This paper elucidated different types of print mottling and identification of various variables contributing for occurrence of different aspects of print mottling in Sheet-fed Offset printing. Offset printing is a planography process based on chemical separation of image and non-image area i.e. 'Ink and Water balance'. Due to this nature of printing process the various types of print mottles were predictable. The maximum frequency of occurrence i.e. 34% was recorded for printer's mottle followed by Water Interface Mottle having a frequency of occurrence of 30%. During research Ink Trap and Back Trap mottling were also commonly observed having 17% and 19% frequency of occurrence respectively.

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