



EVALUATION OF THE METHODS USED FOR OPTIMISING THE CONSUMPTION OF PRINTING SUBSTRATES IN SHEET-FED OFFSET PRINTING PRESS

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1. INTRODUCTION

Offset printing is defined as the printing technique in which inked image or offset is transferred from a plate to a rubber blanket and then to the printing surface. This transfer of offset printing ink to the printing substrate or intermediate carrier through splitting the ink layer is dependent on the following factors:

a) Supply of ink

Offset ink transfer depends on the thickness of the ink layer on the offset printing plates.

b) The period of contact

It also depends upon the period of contact among the printing components to ensure better printing speed and geometry.

c) Printing pressure

The transfer of the ink depends upon the contact pressure exerted by the printing press.

d) Rheological properties of the offset printing inks

The property of the flow of the ink and its viscosity affects the offset printing.

e) Temperature ratios

Rheology of ink depends upon the temperature and hence has an impact on the ink properties.

f) Surface properties

Offset printing has a marked impact of the surface properties like wettability, absorbency, roughness, etc. which makes the printing substrate, printing plate and intermediate carrier.

Structure of Sheetfed Offset Presses

A sheetfed press comprises of a feeder, one or more printing units, a sheet register system along with transfer devices to move the paper through the press, a delivery, and various auxiliary devices like control console.

There are three primary cylinders in the printing unit of a sheetfed offset lithographic press along with the systems for dampening and inking the plate as shown in the figure below-

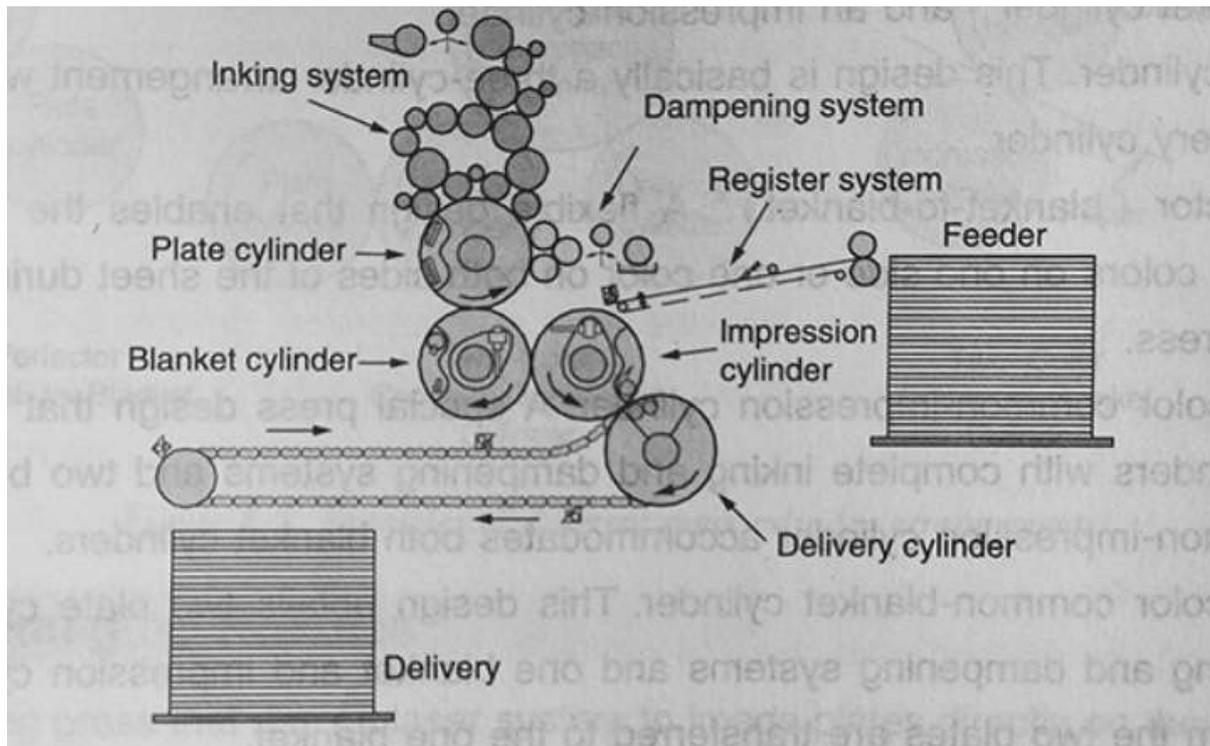


Figure:1 A single-color sheetfed press showing the basic systems common to all sheetfed presses

Plate cylinder-It carries the printing plate which is a flexible image carrier having ink-receptive image areas which when moistened with a water-based solution forms ink-repellent non-image areas.

Blanket cylinder-It carries the offset blanket which is a fabric coated with synthetic rubber which is responsible for transferring the image from the printing plate to the substrate.

Impression cylinder- It runs in contact with the blanket cylinder and helps in transporting the paper or other substrate and forces the paper against the inked blanket.

Dampening system- It is a system which comprises of a series of rollers that carry a metered film of water mixed with other important chemicals which helps in dampening the printing plate. The water-based dampening solution has additives such as acid, gum arabic, and isopropyl alcohol or other wetting agents.

Inking system- Inking system contains an ink fountain that acts as an ink reservoir and a series of ink rollers that transport and mill the ink. These rollers depositing a metered film of ink onto the printing plate.

Feeder- It lifts and forwards the sheets of paper or other substrate from a pile to the first printing unit.

Sheet register system- It provides-

- (1) Alignment that enables every sheet to be registered and printed in the exact same location
- (2) Transfer devices that facilitate sheet transports through the press.

Delivery- It receives and stacks the printed sheet.

Printing substrates- The substrate on which printing takes place are categorised into following categories-

1. Paper
2. Adhesive Substrates for Label Printing
3. Special Laminated Products
4. Polyart Synthetic Substrates
5. Substrates for shrink sleeves
6. PVC(Poly vinyl Chloride) film
7. PET(Polyethylene Terephthalate)
8. Polypropylene Film
9. BOPP (Biaxially Oriented Polypropylene) Film for in mould label printing
10. CAST PP(Cast Polypropylene) Film for in mould label printing
11. PET Film (Polyester)

2. LITERATURE REVIEW

1. An overview of sheet-fed offset presses for optimum consumption of printing substrate (Yadav, Yadav & Singh, 2018).

In this research, the authors have used a case study on Akriti Printers, Noida to explore the possible methods of optimum consumption of the printing substrates in Sheet-fed lithography. The substrates which are used by the researchers are Coated, Un-coated & Polypropylene (PP) substrates



2. Sheet-Fed Offset Printing Press: Analysing & Optimizing The Consumption Of Printing Substrates Like Uncoated Paper, Coated Paper, & Polypropylene (PP) Sheets (A Case Study Of Akriti Printers, Manesar)(Goyat, Singh & Bhupender, 2019)

According to this case study carried out by Goyat, Singh and Bhupender(2019) at Akriti Printers, Manesar, the optimisation of consumption of printing substrate is possible by incorporating some factors like speed of machine, type of printing substrate in In-feed unit at start of Machine, function of printing unit, suitable grade of printing substrate for respective jobs, preparation of job for machine, thickness of printing substrate applied for each particular job, printing time for printing substrate, proper amount of work dampening unit & inking unit, applying of substrate according to printing job, proper water ratio according to printing substrate, machine speed setting according to job and substrate. And printing time for printing substrate. The substrates which have been used for this study are coated Paper, uncoated Paper, and Polypropylene (PP) Sheets

3. Coated paper for sheet-fed offset printing(Haenen, Resch and Scholte,2012)

According to Haenen, Resch and Scholte (2012), when coating paper is used in sheetfed offset printing, image receptive coating layer is formed which contains a top layer and a layer below it having a pigment part made up of 1-95 of 80-95 in dry weight of a fine particulate carbonate or kaolin or clay and 1-100 of 6-25 parts in dry weight of silica and also a binder part made up of 5-20 parts in dry weight of binder and in proportionate to it less than 4 parts in dry weight of additives.

4. Sheet-fed offset printing process and sheet-fed offset printing machine(Koch & Heidelberg, 2003)

According to Koch and Heidelberg(2003), delivery of a sheetfed offset printing machine helps in preventing the uncontrolled spread of powder in the housing by emerging out the powder-laden air from the housing and feeding in the air into the housing from conveyor belt. There is a channel of air created inside the housing which creates drag and drift effects through which machine works.

5. Investigation of the printing pressure level application influence on sheet-fed offset print quality(Milosevic, Stancic, and Adamovic, 2013)

Milosevic, Stancic and Adamovic claim that the sheet-fed offset printing technique requires high contact pressure between blanket and impression cylinders to transfer the adequate ink onto printing substrate. The research aims to find out the impact of different print quality factors on applied printing pressure levels between blanket and impression

cylinders, during four colour sheet-fed offset printing process with the help of different image processing tools. The printing substrates which are taken into consideration for testing are gloss and matte-coated papers.

6. Offset printing unit(Koppelkamm, et.al., 2002)

Koppelkamm and others in their research describe the structure of an offset printing unit which has at least one-cylinder pair with a form cylinder and a transfer cylinder. The transfer cylinder helps in supplying the ink to the printing material with the help of impression cylinder. In order to enhance the production output, the form cylinder combines with five printed pages-one in the circumferential direction and in the longitudinal direction with at least four.

7. Most Common Printing Defects in Sheet-fed Offset Printing on Various Grades of Printing Paper(Baral, Gupta and Kumar, 2014)

According to Baral, Gupta and Kumar, 2014, there are many defects which increase the wastage during a press run. As per the results of the study, the average sheet wastage due to various defects in typical sheet-fed offset is 5 (+/-2) %. Some of the common defects are Dot gain, hickey and mottle on uncoated paper stocks. Matte and Gloss grade coated stocks also undergo defects like picking, set-off and rub off. However, there are some defects which are independent of paper stocks used like tinting, scrumming, slur and ghosting.

8. Optimizing Solid Ink Density of Various Inks on Uncoated Printing Substrate in Sheet Fed Offset Press. (Baral and Joshi, 2016)

This research indicates that solid ink density is an important factor in analysing the print quality. It also explains that for the study uncoated papers are chosen as they have medium quality and their consumption is higher than other types of papers.

9. Optimizing Make Ready and Waste Minimization in Sheet Fed Offset Printing for Cost Effective Packaging and Printing(Mehra, S., 2017)

This paper explains the need of reduction in costing to attain the competitive advantage without compromising with the quality of the product. This research paper has explained the necessity of minimising the wastage and unproductive activities by taking care of environmental impact of industries.

3. RESEARCH OBJECTIVES

To evaluate the methods used for optimising the consumption of printing substrates like uncoated paper, coated paper and Polypropylene(PP) sheets in Sheet-fed offset printing press-A case study of GroPrint, Noida.



Objectives' framework

1. To analyse the consumption of printing substrates in sheet-fed offset printing press.
2. To find out the ways of optimising the consumption of the printing substrates like uncoated paper and Polypropylene sheets in sheet-fed offset printing press of GroPrint.
3. To evaluate the percentage of wastage reduced and number of substrates decreased by using the optimisation.

4. RESEARCH METHODOLOGY

This research is using the mixed approach by incorporating qualitative case study approach in which different printing substrates used in printing industries are studied and the quantitative approach in which the results of the percentage of wastage and reduced number of substrates claimed by other researchers will be evaluated. The company which is chosen for the research is GroPrint under which different jobs of Sheet-fed offset printing done on different substrates are studied to consider their consumption.

5. DATA COLLECTION AND ANALYSIS

The data which has been collected during the case study for the consumption of different printing substrates has been compared with each other to analyse their optimum utility.

6. RESULTS AND DISCUSSION

There is a case study by Goyat, Singh & Yadav (2019), stating that wastage can be minimised by 12-15% and consumption of substrate can be reduced by 400-600 pages if some strategies are used in the sheetfed offset printing process. This result has found that wastage can be reduced to 8-12% by using some precautions which is evaluated through the comparative analysis of the obtained data has been used for discussing the consumption of printing substrate in sheet-fed offset to check the validity of the outcomes. It is important to use change management and waste management tools to reduce the wastage.

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