

Factors Affecting Printing Quality of Paper from Bagasse Pulp

K. Kumaraguru, M. Rengasamy*, E. Titus Praveen Kumar, D. Venkadesh

Department of petrochemical technology, Anna University (BIT Campus),
Tiruchirappalli- 620024, TN, India.

*Corres.author: mregasamy@rediffmail.com

Abstract: The printing industry is the largest collective consumer of paper products and estimated that around 43 trillion papers are used for printing annually across the country. As the printing industry continues to reduce the cost and improve the quality of paper, the effective measurement of printing quality is very important. Most common problems affecting a bagasse pulp printing paper includes pulping, piling, linting, warm weather complaints, cold weather complaints, effect of press moisture, grain long, pH problems and types of picking. This paper reviews about various problems occurring in printing a paper produced from bagasse pulp, causes for problem during printing and their corrective actions to be taken to improve the printing quality.

Keywords: printing factors, bagasse pulp, printing quality.

1. Introduction

Printing is a process by which qualities of images are produced on paper or another substrate, using a printing plate or image carrier, ink, with a help of printing press. The impact of printing has a day to day effect around the world. The members of this industry call printing as “the art preservative of all the arts” (1). This is due to the fact that with the aid of this invention we are able to make permanent records of current events.

The quality of a printing paper is an important factor to decide the quality of printing over it (2). Globally, the main challenges of the printing industries are to meet the global market need in such a way to produce paper of different specifications, depends upon its usage (3). Some papers are suitable for any one specific purpose, like security papers are used for money printing, for representing values, etc. while others may be suitable for two or more printing purpose like computer printing, toilet paper, newspapers, etc (3, 4).

2. Printing Process

Various printing process techniques are used for printing purpose. Three basic methods are commonly used for direct or contact printing (4)

- * Relief method (From a raised surface)
Relief letter press and flexography
- * Planographic method (From a flat surface)
Lithography (offset) screen-printing and mono-prints.
- * Intaglio method (From a recessed area)
Engraving, dry-point, etching, aquatint and mezzotint.

Printing Process Requirements

The papermaker needs to understand the requirements of the printer in order to produce suitable papers for printing. Runnability and printability are the two major factors need to be considered while printing (4, 5).

- **Runnability**

Runnability is the process in which the paper passes through the press without breaks. It leads to produce trouble free printing process and high productivity (5). A poor running sheet will cause problems or necessitate slow operation of the presses which adversely affects the economics of printing.

It is also important from a runnability standpoint that the paper rolls or a pallet of paper starts to arrive at the press room in good mechanical condition. Paper strength, uniformity and freedom from defects are the important properties which affects the runnability during printing.

- **Printability**

Printability is the effect of the reproduction of the images sharply and correctly without the displacement of ink on the paper. Printability is the interacting result of different paper-related factors in printing process, which contribute to the full use of the quality potential of the paper in the print process (4).

Parameters for printability are mainly their properties that influence the visual quality of a printed product. Printability is not the same as print quality because print quality is also determined by other factors of printing technology (5).

Brightness, opacity, gloss, smoothness, porosity, and sizing are the important properties of paper, but the requirements may vary based on the printing process. Typically, coated papers have better appearance than uncoated paper (6), due to impressed smoothness, brightness and gloss.

Pulping

Pulping is a process which extracts fibrous material and cellulose from wood or other raw materials as a prelude during paper making (3). The purpose of pulping is to liberate cellular fibres from other chemicals and other impurities in the wood. Before wood can be pulped, it should undergo debarking. Bark contains little or no fibrous material. It can be removed either mechanically or hydraulically. Usually debarked woods are used for pulping.

- **Bagasse Pulp**

Bagasse is an agricultural residue in which mainly fibrous material remains. Paper making with bagasse, as the major raw material (4, 5) has been posing several challenges as

- Bagasse is a bulky raw material and is difficult to handle.
- Bagasse requires mild bleaching and refining conditions to avoid damage to the fibre.

3. Factors Affecting Printing Quality

Pulping and paper making are the preliminary aspects of the paper quality product. The real challenge comes when the product is put into its intended fundamental end printing industry (7). The following are the various factors that affect the printability of paper. The reasons and their solutions are discussed.

- **Bagasse Pulp Properties vs Printability**

- **Role of Oil Absorbency and Paper Porosity**

Various printing processes require inks for printing different characteristics. An ink's dyeing time depends on the physical attributes of a paper. Mainly the printability property is influenced notably by oil absorbing nature of the base pulp. Pulp having more oil absorbency tends to take more ink (9). Too high oil absorbency is reported to cause more show since excess oil reduces the opacity of the paper and tends to make it transparent after printing.

➤ **Improving Porosity and Oil Absorbency**

The presence of pith (parenchyma cells) in bagasse results to form a close sheet with low porosity and oil absorbency (9). The oil absorbency is directly proportional to the porosity of the sheet. Low oil absorbency of bagasse based paper tends to take-up low ink, i.e. the ink demand for bagasse paper is low. Fast drying ink and heat set offset process are best suited for low porosity paper. Further studies need to be on ink formulation for agricultural residue base paper, since the ink used for normal wood based paper needs modification for bagasse based paper.

Improving porosity of a paper in case of bagasse is very difficult due its closeness of sheet formed due to presence of amorphous pith. Use of fillers of high surface area, will fill the inter fibre space and improves the porosity of paper (9). Earlier studies reveal that among the various fillers, precipitated calcium carbonate gives a profound increase in porosity particularly bagasse paper, whereas wet consolidation of the sheet does not improve the porosity.

• **Grain**

Grain-short paper is specified for making black and white or single colour work with good folding (or) economical layout. But even here, a wavy-edged (or) tight edged condition can develop along with the gripper edge which causes trouble in feeding on any type of press (or) offset duplicator.

Bad register in multi-colour printing by using short grain paper may stretch greater (or) shrink greater (7). These problems occur in a printing paper due to low stiffness in short grain. In order to avoid stretching or shrinking of image printing long grain paper can be recommended.

• **Fountain Solution**

A mixture of water and other chemicals distributed by the dampening system on a printing press is used in offset lithography. A fountain solution may contain a drying stimulator which works to enhance the effectiveness of the dryer when mixed with the ink(8).

In this technique, emulsification problem, scumming and drying difficulties are the major problems in a printing paper. These problems are due to pH variations of the fountain solution, higher or lower the value of pH may affect the quality of printing to a greater extent. These problems can be prevented by maintaining the pH range constant in the range 4.7-6.0 with the help of chemical buffer system with good buffer capacity.

• **Bulk Problem**

One of the most important characteristics that affect the printing is bulk or specific volume. It is the inherent nature of the raw material used in the printing (9). Two approaches are possible to improve the bulk, since low bulk has to improve for getting the improved resiliency during printing by addition of fillers like PCC (precipitated calcium carbonate) or inclusion of some amount of high bulk pulps such as hard woods and soft woods (10).

• **Dimensional Problem**

One of the major problems in offset printing is the curls and changes in paper dimension design. These are mainly caused by absorption of water, softening and weakening of the paper surface, which leads to picking and transfer of excessive moisture from the press dampening system (11). Proper sizing of the paper can avoid the above said problem.

• **Piling**

Piling is a printing problem caused by the accumulation of paper fibres, bits of detached coating particles and other debris on the printing plates or blankets in the image or non-image areas. Piling can be occurred by various reasons in addition to basic surface debris.

This is caused mainly due to the improper formation and sizing of the bagasse paper during production. This can be avoided by improving bonding, by increasing the efficient sizing and using the tackier inks that overcome the paper's pick resistance.

- **Strike-Through**

Strike through is an often encountered print quality problem caused by ink penetration and insufficient opacity of paper. If the strike-through of a paper is high, it leads to very dull images and an impact on the other side of the paper.

The rate of absorption has a direct impact on the strike-through of a paper. The strike through of a paper is very large when the rate of absorption is high. This can be avoided by using suitable filler during paper making.

- **Linting**

Linting is described as the tendency of a paper to shed loosely bound fibres and fines that decrease the quality of a paper. White fibre shaped spots, short life of the printing plates are the reasons for linting (8). Bonding of fibre to the surface of paper is not complete. Tacky ink picks up the loose fibre as they accumulate on the blankets and rollers of the press. The fibres absorb water and when they are saturated, they repel ink. This can be avoided by improving the quality of paper surfaces.

- **Moisture Content**

Moisture content directly affects reliability and print quality. Too much moisture can cause excessive curls, jams and print quality problems. Too low moisture level can cause static problems, which can also lead to jams as well as cause difficulties in post-processing paper handling (10). This can be avoided by using the paper which has the moisture content of 4.5%. Moisture proof reaming papers are essential to maintain the correct moisture level of paper.

- **Hot & Cold Weather Complaints**

Wavy edges, wrinkled sheets, tight edges, shrinking and retarded ink drying are the most common complaints during printing and paper manufacture during heavy rain and humidity create wavy edges and cockling papers to wrinkle. It leads to increase in calliper and basis weight. Winter coldness and dryness cause static to plague printers. This can be avoided by storing and printing in a well-controlled temperature and humidity conditions (8).

- **Smoothness**

The smoothness of paper has a significant impact on quality of the image. The image quality degrades when the paper is too rough. An extremely rough paper does not allow proper toner diffusing. Digital color grade and coated paper are used for better quality printing requirement (7).

- **Picking**

Papers can exhibit picking when subjected to high stress, which develops during ink application. There are two types of picking namely dry and wet picking. Dry picking occurs when oil based ink is used in printing. When an offset process uses water additionally, that may weaken the coating further leads to form Wet picking (11).

This can be avoided by using binder in sufficient amounts based on the binder demands.

- **Gloss Level**

The gloss level of paper is measured by the ratio of reflected to incident light. It is the reflectance of the surface, responsible for its shiny or lustrous appearance (6). A higher gloss is achieved by making the surface more reflective through a combination of calendaring (pressing) and/or coating choices.

4. Conclusion

Nowadays the recent advancement in paper making technology is a boon to the industry. By maintaining the above pre and post paper making process, we can get good quality of printing. Though risk and cost remain main criteria in decision making process, when these factors are balanced in a long term vision

through ambience, it can produce paper from bagasse pulp and create innovating opportunities in challenging the global market demand rarely.

References

1. Handbook of Pulp and Paper Technologists – Gary Smook (Second edition)
2. Hand book of pulp and paper Technology – Kenheth W. Britt (Second edition)
3. H.J. Marrinan., Recent advances in Chemistry of Cellulose and Starch, Edited by H.Honeyman, Published by Heywood & Company Ltd., London., 1959, P 148.
4. Eldred, N.R., “Printing fundamentals” Ed Alex Glassman, Tappi press., 1995, p317-323
5. Walker W.C., Marton J, “Printing fundamentals and basics” Alex Glassman, Tappi press., 1985, P 281-285
6. Cobb, R.M.K, “Coating adhesive demand – what pigment function governs it ?”, TAPPI J., 1958, 41 (10), 581-600
7. Dewitz, A., “Paper for Digital Printing”. RIT - School of Print Media, 2004., Retrieved February 24, 2009, from <http://printmode.net/downloads/paper-fordigital-printing.pdf>.
8. M.F. Graftonn and P. Frigon, predicting lint property of paper at the mill: a test that works.
9. Siying Chen, Effects of Paper Properties on Xerographic Print Quality, pg.16-26.
10. Xerox corporation, Helpful facts about paper, what you need to know!, pg.11-18, 25-29
11. Sonya.F.Rand, Linting of paper in the offset printing process.

EXTRA PAGE
International Journal of ChemTech Research
(Oldest & Original)

CODEN (USA): IJCRGG, ISSN: 0974-4290 [www.sphinxesai.com]

Journal's url= <http://sphinxesai.com/frameijchemtech.html>

Subject area:

This Journal publishes the Research/Review papers from all branches of Chemistry, Chemical Engineering and applied sub - disciplines like Synthetic Chemistry, Analytical Chemistry, Environmental Chemistry, Biochemistry, Polymer Chemistry, Chemical Engineering, Chemical Technology, Petroleum Chemistry, and Agricultural Chemistry, Biotechnology, Nanotechnology Pharmaceutical, Biological activities of Synthetic Drugs, *etc.*

[1] RANKING:

has been ranked NO. 1. among the journals (subject: **Chemical Engineering**) from **India at International platform.**

It has topped in total number of CITES AND CITABLE DOCUMENTS.

This ranking is done by Elsevier- SCOPUS-USA (A LEADER DATABASE SCI. ORG. BASED AT USA).

Find more by clicking on Elsevier- SCOPUS SITE....AS BELOW.....

http://www.scimagojr.com/journalrank.php?area=1500&category=1501&country=IN&year=2011&order=cd&min=0&min_type=cd

Link =

<http://www.scimagojr.com/journalsearch.php?q=19700175055&tip=sid&clean=0>

Paste this link in a spacebar and click/enter.

http://www.scimagojr.com/journalrank.php?area=1500&category=1501&country=IN&year=2011&order=tc&min=0&min_type=cd

Please log on to - www.sphinxesai.com
