Green Printing: Inevitability for Printing Industry Sustainability

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ABSTRACT

Freedom to subdue and dominate over the environment by human being is the most precious gift perhaps the Omnipotent God has ever blossomed on Mother Earth. But same human is continuously deteriorating this privilege unintentionally by his physical activities day by day. Such harmful activities are resulting imbalanced phase in nature surrounding us. Green printing is merely the solution of all the cruxes related to our eco system especially for printing and packaging industry. Green printing facilitates the reduction of hazardous chemicals like Volatile Organic Compounds (VOCs) and gases emission during numerous printing processes. The key objective of this research paper is to elucidate significance of green printing on the environment and how green printing helps to curb the equilibrium among human and nature by reducing hazardous chemical and synthesis effectively in this modern age.

Keywords--- Environment, Eco friendly, Printing, Packaging, Green Printing, Hazardous chemical and synthesis

I. INTRODUCTION

Green printing makes acquainted with new initiative made for printing industries by taking the environmental impacts into prime consideration. A lot of adverse effects are associated with emission of Volatile Organic Compounds (VOCs) and gases due to chemicals used while printing. Common environmental issues are among them. In order to mitigate these aroused problems during printing, green printing strategies have facilitated new effective and efficient solutions. Green printing initiatives are more beneficial for protecting the environment from hazardous chemicals and synthesis. Green printing strategies are formulated for offering immediate environmental benefits by using green printing substrates and inks, minimizing emission of gases and VOCs.

II. VOLATILE ORGANIC COMPOUNDS (VOCs)

Volatile Organic Compounds (VOCs) and gases are the most common emissions produced during the printing processes from different cleaning solutions and chemicals. Some adhesives used in post-press sections are also responsible for VOCs emissions. VOCs released into the atmosphere are odorous and toxic in nature. Volatile Organic Compounds includes ketones, aliphatic and alcohols which are contained in printing inks, fountain solutions and cleaning chemicals. Petroleum based product like mineral spirits, methanol and toluene are cleaning chemicals used for roller washing, blanket cleaning also responsible for emission of VOCs in the environment.

Origins of VOCs in Printing Process: In gravure and flexography printing processes generally solvent based inks are used because of the nature of printing process. During printing these volatile solvents emit vapours. Ink and solvent used in heat-set lithographic printing process is also responsible for the contribution of emission of VOCs in the environment. Some adhesives and glue used for various post-press operations causes VOCs emission.

Minimizing VOCs in Printing Process: - Only alternative to save our environment is either elimination of hazardous chemicals or minimizing their usages up to lowest level as far as possible. Some considerations which are of prime significance are enlisted as below:-

1. Opting printing methodology in where fewer chemical consumption is required
2. Replace hazardous chemicals to those which offers lower emission of VOCs
3. Proper maintenance of printing equipments
4. Cleaning of press immediately after printing
5. Technology upgrade which is eco-friendly

III. ADVANTAGES OF GREEN PRINTING
Green printing has a lot to offer for the environment especially. Also results in saving on printing cost. The expenses could be curtailed up to 70% or more depending upon the way in which green printing strategy is implemented in any printing organization. Overall benefits offered are enlisted as below:-

1. Environmental concerned i.e. Conservation and preservation of environment
2. Wastage reduction of consumables used during printing like chemicals, paper, ink etc.
3. Overall cost reduction of the production
4. Time and energy saving
5. Offers enhanced quality of printing with improved standards
6. Safer workplace with improved employee health
7. Reduced use of hazardous materials for lowering environmental impacts

IV. OBJECTIVES OF STUDY

The key objectives of this research article are to explicate the different aspects of green printing for minimizing the impact of hazardous chemicals and synthesis on our environment. Various aspects taken into account are:-

1. Green Printing Principle/Strategy
2. Green Printing Substrates
3. Green Printing Inks
4. Tips for Eco-friendly Printing Industry

V. MATERIALS AND METHOD

In order to cope up the various environmental issues related to our green earth opting green printing is need of the hour. Green printing makes acquainted with various ways which make the printing processes eco-friendly. In this way green printing is exploring multi-dimensionally.

1. Green Printing Principle/Strategy

There are numerous ‘green printing principles/strategies’ to choose from. There is no hard and fast rule to follow for implementing green printing strategy but the key objective is to be eco-friendly. These various strategies suggest some steps to opt green printing. Some strategies are delineated here:-

STRATEGY 1:

Any strategy is a set of particular norms to follow for efficient outcomes. Various points to be considered are explicated as below:-

Cost Reduction: - Printing organization should focus on being energy and consumables efficient which will help in real cost saving. Such ‘green’ efforts improve the efficiency and results more profitability for the organization.
Wastage Reduction: - Wastage generation means inefficient usage of natural resources causes more cost of production, reducing profit. Careful examination and opting suitable methodologies can help in ‘go green’ and wastage reduction.

Employee Health and Safety: - More efficient operational methodology not only offers smooth organization work flows but also provide safer working environment for employees and helps avoiding mishap. This is also another aspect of green printing taken into account.
Customer Loyalty: - It is the moral responsibility of organization to be loyal for the customers.
Competitive Advantages: - Opting mention strategies for efficient working will help not only cost cutting but also improved quality work. Quality work and cost cutting of production will help better sustainability to compete.

STRATEGY 2:

Implementation of green printing strategies is not confined to industries only but it can also be used in practical life also. Printing is one among the crucial environmental impacts associated with day-to-day operations. This is the easiest approach to tackle with delivering immediate environmental benefits. This strategy is based on the hypothesis that any printing process has three main environmental impacts i.e. substrate (paper) on which to print, ink for imparting information and energy consumed i.e. power while printing. Some practical green printing tips and advised to follow are enlisted here:-

Paper Reduction: - Generally for office work most of the work done while printing is made single sided which must be avoided and double side printing should be done. Using both sides of paper is one of the easiest ways of reducing the paper consumption. This process directly reduces the consumption of paper by 50%. Another alternative of reducing paper consumption is ‘Think before Inking or Print only whatever is needed’. Many research indicates that most of the consumption is just because of unused and wastage publication. While purchasing paper its recyclability aspect should also be taken into account because recycled paper has lower environmental impact while producing it.

Ink and Toner Reduction: - Ink and toner used is another aspect of crucial importance that is directly associated with environmental impact. Ink is the basic foundation for any printing process which is highly hazardous. Avoiding unused and wastage printing also help a lot for saving extravagant ink and being eco-friendly in nature. Another aspect taken into consideration is that only purchase vegetable based ink and toner. Now days most ink and toner are manufactured vegetable based which results in lower emission of Volatile Organic Compounds (VOCs) resulting greatly minimizing environmental hazards. Also disposal of ink should be made properly.

Energy Consumption Reduction: - In order to operate any printing process or printer it requires energy. Efficient printing and avoiding unnecessary printing will reduce the energy consumption. This will help reducing carbon
footprint and saving electricity. Many printers are available with energy saving settings which facilitates to setup printer on ‘sleep mode’ resulting energy saving. Hence it must be emphasized on being energy efficient which will help in real cost saving.

2. Green Printing Substrates

Substrate and ink are the foundation of any printing processes. Green printing substrates have equal importance in making this technology green. Use of the green printing substrate contributes up to an extent for this environment. Various types of substrate used include:

- Recycled Paper: This is the paper made from the paper mill scraps, discarded paper materials and waste paper materials. Paper is one among those materials which can be recycled easily. Using recycled paper offers minimizing environmental impacts.

- FSC Environmentally Paper: An FSC (Forest Stewardship Council) is a certified company which satisfies forest management standards. This certificate is awarded not only to forests or lumber companies managing forests but also to processing and distribution processes like furniture or paper manufacturers.

On the basis of recyclability, any recycle paper offers three alternatives varies from Good choice to Best choice. These are enlisted as below:

1. **Good Choice:** - Paper which is minimum 10% recycled.
2. **Better Choice:** - Paper which is minimum 30% recycled and Enhanced Elemental Chlorine Free (EECF) Processed Chlorine Free (PCF) or Total Chlorine Free (TCF).
3. **Best Choice:** - Paper which is minimum 50% recycled and Processed Chlorine Free (PCF) or Total Chlorine Free (TCF).

3. Green Printing Inks

Green printing inks are another basic need of printing processes. Green printing inks provides the lower emission of Volatile Organic Compounds (VOCs) and gases which greatly minimizing environmental hazards. Various types of green printing inks used are delineated as:

- **Vegetable Inks:** - Vegetable based inks are kinds of environment-friendly ink made from vegetable oils. Although vegetable based inks take long time to dry but such inks are considered better in terms of performance because of drastically reducing the amount of VOCs as these are prepared from the vegetable oils. These inks release approximately 2-4% VOCs emission which is very less comparatively solvent-based inks. On the other hand, water based cleaner can be used for cleaning of vegetable based inks rather than solvents.

- **Soy based Inks:** - Soybean oil is used as vehicle in order to prepare soy inks. Being soybean oil is a natural source of oil it offers the naturally low in VOCs features resulting lower impact on the environment. Soy is also a renewable resource which is relatively easy to grow. Also soy based inks facilitates very clear, brighter and vibrant effects and complete absence of heavy metals in ink composition. Because of these features newspaper industries have opted soy inks these days. It is also easy to recycle the paper printed with soy inks. Now a day soy inks can also be used for laser and inkjet printers.

- **Water based Inks:** - Water based inks are buzzing around the world because of the features these are offering and also known for providing the soft print quality of ink. Rather than making use of harsh chemicals, water is used as vehicle for manufacturing water based inks and non-hazardous inks for environment. Water based inks pigments are suspended in water. These inks offer more bright and vibrant colors. Availability of water based inks facilitates VOC free environment during printing. Also these inks are abstaining from ozone layer depleting chemicals like CFC and HCFC. Other characteristics provided by water based inks are pH stability, oil resistance, fast drying and low viscosity.

Various inks opted for green printing has lower impact on the environment. As per the advice by National Association of Printing Ink Manufacturers, following aspects must be taken into consideration: - inks must have following features/suggested are:-

- **Lower Volatile Organic Compounds (VOCs):** - Solvents used while ink manufacturing must have low VOC content. Inks with lower VOC content have lower emission level while printing which would be beneficiary for the environment. Over the last decades ink manufactures have made remarkable progress in this direction.

- **Bio-derived or renewable materials:** - Generally it is considered that use of bio-derived renewable oils while ink manufacturing results in improving overall environmental impact. Because these materials have lower VOC content e.g. Soy or vegetable based inks having naturally low in VOCs are better alternative.

- **Reducing use of Heavy Metals:** - Some inks consist of heavy metal like lead, arsenic, selenium, chromium, mercury and cadmium used for bright color printing. Such inks are toxic ink nature. Now a day such inks are manufactured without the use of toxic compounds.

- **Reduced use of Hazardous Air Pollutants:** - In order to reduce the environmental impact, minimizing the use of hazardous air pollutants (HAPs) is another effective alternative.

- **Recyclable Products:** - Although while recycling of paper most inks are removed by deinking process. But efforts are still continued for the recyclability aspect of inks and are under consideration.

- **Reduced Hazardous waste:** - Generally solvent based inks are classified as hazardous due to their inflammability characteristics should be avoided as far as possible. Other alternatives are available now days.

4. Tips for Eco-friendly Printing Industry

Key objective of green printing is to offer implementation of strategies resulting immediate environmental benefits by reducing hazardous chemicals.
In order to change traditional printing industry to green printing industry, some initiatives to be made are enlisted as:

3R Principle: - Acronym for 3R is Recycle, Reduce and Reuse. In order to implement the green printing, 3R is the basic foundation. Non chlorine bleached recycled paper and recycling used paper is recommended. The performance of the recycled paper is at par to virgin paper. Another factor is that wastage must be reduced as much as possible. Reusability aspect must also be taken into consideration in order to be eco-friendly.

Using Eco-friendly Inks: - Inks have low Volatile Organic Compounds (VOCs) can greatly minimize health risks. As per the recommendations provided by Printing Ink Manufacturers, soya or vegetable based inks reduce environmental impact. Such inks have limited adverse impact on ozone layer. Metallic inks have greatest impact on environment must be avoided as far as possible.

Think before Inking Or Print only what is need: - Avoiding unused and wastage publication can also help to be eco-friendly in nature. Print on demand facilitates to print content whenever it is needed. Print on demand produces more timely and targeted information resulting in wastage reduction, storage and pollution as well. Such practice should be practically opted for avoiding the consumable wastage.

Avoid printing with polluting Inks: - Industry must avoid Volatile Organic Compounds (VOCs) based inks because these are petroleum based derivatives causes cancer. Also these inks release toxins in air. Soy or vegetable based inks are better alternative having naturally low in VOCs. Also some inks consist of heavy metal like lead, mercury and cadmium commonly used for bright color must be avoided.

Use online proofing and approvals: - Conventional methods involves numerous times printing resulting in wastage of paper, ink, chemicals, films etc., but digital printing have eliminated these steps. So such time consuming and wastage generation operation should be avoided.

Provide a web portal to customers for Job order: - Every printing organization should opt for company’s website where customer can order, request and submit jobs online. It will help not only in saving paper work but also enhancing the workflow of the printing smoothly and effectively.

VI. CONCLUSION

This paper has explicated an overview of green printing and its exploration in printing industry from various perspectives for offering immediate environmental benefits. Although new developments have offered enhanced the quality and credibility in various ways, but the importance of green printing is of prime significance. Efficient implementations of green printing strategies in printing industry are the way to offer all around excellence. Green printing aims at lower emission of VOCs and gases, reducing consumption of hazardous chemical and carbon footprints during production cycle in printing industry. It is only the green printing offering holistic approach of sustainability in the printing industry. It encompasses numerous facilities not only providing the immediate environmental benefits but also ensuring the health and safety of the employees. Hence in this modern era green printing is proving to be boon for printing industries.

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