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SURVEY FOR IDENTIFYING NON-ECO FRIENDLY PRINTING ACTIVITIES IN VARIOUS STAGES OF PRINTING WORKFLOW

N. Nandini, P. Hema

Department of Printing Technology
Avinashilingam Institute for Home Science and Higher
Education for Women, Coimbatore, Tamil Nadu, India.

T. Miruthubashini R. Viveka

Assistant Professor Department of Printing Technology
Avinashilingam Institute for Home Science and Higher
Education for Women, Coimbatore, Tamil Nadu, India.

Abstract— This paper presents the study of parameters affecting the environment by the non-eco-friendly activities in the printing industry. The survey identifies the non-eco-friendly activities in various stages of printing processes and also identifies the VOC Emissions, Carbon footprint, and Wastage of Calendar & Newspaper Printing. Data were collected from both primary and secondary sources to fulfill the aim of the survey. The primary source of data was collected from the companies and the Secondary source of data was referred from a journal, published articles including the internet. The presented concept, Methodology, and results represent the contribution to sustainable development management. The paper analyzes the results of the quantitative identification of hazardous substances emitted in the printing industry. The main focus of this survey is to find out the non-eco-friendly activities and provide suggestions to make the environment better.

Keywords— Non-eco friendly, Voc Emission, Carbon footprint, Wastage, Suggestions, Environment

I. INTRODUCTION

This study proposes Non-Eco friendly activities assessing the environmental performance of a specific printing product. Environmental sustainability concepts are just being applied in the printing sector: a critical analysis has highlighted that environmental eco schemes are widespread; a few of interest have been addressed by research papers. The approach proposed aims to collect and merge environmental features of Non-Eco-friendly with data about printing activities carried out directly by the firm. Thus, the model allows a fast but integrated assessment of the whole environmental sustainability level of printing activities.

Eco-friendly printing makes acquainted with new initiatives made for the printing industries. By taking the environment impacts into the consideration, we have to overcome all the non-eco-friendly process or products in the three departments of the printing workflow.

The main focus of this project is to find out the non-eco-friendly activities and find out the impact of print industries through the wastage released during printing, the amount of co₂ and VOC's is emitted during the processes. Only alternative to save our environment is either elimination of hazardous chemicals or minimizing their usage up to the lowest level possible.

II. LITERATURE REVIEW

In today's world, print is very important in day-to-day life it starts by looking into the attributes or requirements of eco-friendly printing industries, associated environmental impacts such as reduce global warming, increase of sustainability, maintain environmental conditions as well human wealth. The importance of considering environmental factors will make a drastic change in-universe.

Production in the print industries has involved the universe in the use of different chemical compounds which have the degrading effect on the environment, exploitation of the forest nature resource and destroying the natural ecosystem.

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 a green printing strategy but the key objective is to be eco-friendly. These various strategies suggest some steps opt for green printing[1].

Carbon footprint in print industries:

In print production, when the press is running during its availability, the printers should know wheatear the quality of the printed sheet is acceptable, co₂ emission from the printed room can be reduced by the downtime, it considers the print quality criteria by preference customer, we can see that the factors enhanced in the printing process are improved conditions, then by this survey the significant reduction of co₂ in printed products and process is reduced, a continuation of this effort is likely to raise new research challenges and ultimately to help us in building more sustainable printing industries[2].



Waste management impact of print industries:

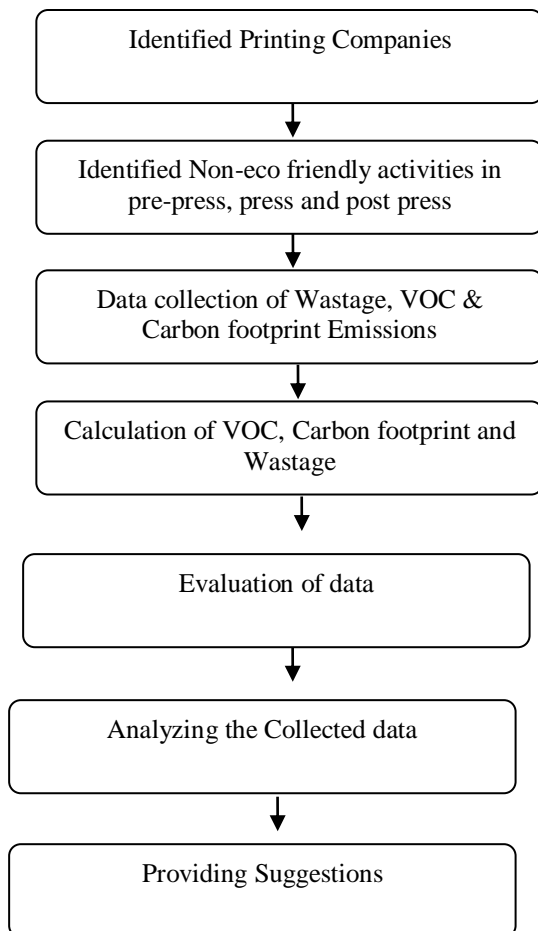
Waste is defined as something lying unproductive, inhabited, or desolate. Generally, all waste appears in three forms namely: solid waste, wastewater (liquid waste), and air emission, a Waste reduction which is vital to the growth and development of printing houses in Ghana cannot be overemphasized. To run a printing house as economically and efficiently as possible, one should reduce all types of wastes including hazardous wastes, solid wastes, and air and water emissions. Waste generation is inevitable in the printing industry. All the printing processes, namely, offset lithographic printing, gravure printing, flexography/letterpress, and screen-printing use materials and chemicals [3].

VOC Emission in print industries:

Origins of VOCs in Printing Process: In gravure and flexography printing processes generally, solvent-based inks are used because of the nature of the printing process. During printing these volatile solvents emit vapors. Ink and solvent used in the heat-set lithographic printing process are also responsible for the contribution of emission of VOCs in the environment. Some adhesives and glue used for various post-press operations cause VOCs emission [4].

III. METHODOLOGY

This project involves identifying non-eco-friendly activities in various stages of the printing process and also involves calculating VOC Emissions, Carbon footprint, and Wastage of Calendar and Newspaper printing.



A. NON-ECO FRIENDLY ACTIVITIES EFFECTS ON HUMAN HEALTH

Non-Eco Friendly Activities in Pre-Press:

i. Etching, Engraving, photographic reproduction.

Causes: Nitric, sulphuric and hydrofluoric acids can skin burns, eye damage, and blisters.

ii. Concentrated photographic developer or fixer solutions.

Causes: Acidic and hydroquinone can irritate eyes and even cause dermatitis.

Non-Eco Friendly Activities in Press:

i. Solvents, fount solution, blanket restorers, cleaning solvents, Lithographic fount solution.

Causes: Ammonium, Potassium and sodium dichromate are all very corrosive and cause deep ulcers as well as a risk of cancer.

ii. UV and infrared curable inks, Varnishes and lacquers.

Causes: Reactive acrylates or methacrylate can cause corrosion of the skin, eyes and micro membranes.

iii. UV lamps for photo processing, UV curing and high-speed printing-Ink misting.

Causes: Fumes can irritate respiratory tracts with the potential for occupational asthma as well as severe headaches and nausea.

iv. Flexographic dyeline printing and screen inks.

Causes: Perchloroethylene, ammonium hydroxide and ketones can cause dermatitis, dizziness and other effects on the central nervous system.

Non-Eco Friendly Activities in Post-Press:

i. Adhesive laminating.

Causes: Isocyanate prepolymers can irritate the airways and lungs leading to occupational asthma.

B. DATA COLLECTION

Data for the study was collected via primary and secondary means. Secondary data was obtained from the internet, journals, articles, company reports. Primary data was obtained from the companies was shown in Tables 1,2,3.



Per day Usage			
S.No	Material	Calendar	Newspaper
1	Ink	1100 g	34.1 kg
2	Solvents	340 g	0.5 kg
3	Fountain solution	220 g	2.05 kg
4	IPA(Isopropyl Alcohol)	90 g	0.5 kg
5	Glue	340 g	0.34 kg

Table 1, Data of VOC Emissions

Per day Usage					
S.No	Material	Calendar		Newspaper	
		Usage	Wastage	Usage	Wastage
1	Paper	41.66 kg	2.77 kg	7200 kg	6.276 kg
2	Ink	101 kg	0.09 kg	34.11 kg	2.16 kg
3	Gum	0.34 kg	0.044 kg	0.34 kg	0.066 kg
4	Solvents	0.34 ltr	0.077 kg	0.5 kg	0.122 kg
5	IPA (Isopropyl Alcohol)	0.09 ltr	0.0055 kg	0.5 kg	0.066 kg

Table 2, Data of Wastage

Table 3, Data of Carbon footprint

Per day Usage			
S.No	Procurement	Calendar	Newspaper
1	Ink	1.11 kg	34.11 kg
2	Paper	41.66 kg	7200 kg
3	Plate Making	0.157 kg	0.157 kg
4	Electricity	1.314 kg	1.644 kg
5	Wash up solvents	0.035 kg	0.063 kg
6	Glue	0.34 kg	0.34 g

IV. EXPERIMENT AND ANALYSIS OF DATA

A. VOLATILE ORGANIC COMPOUNDS

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

CALCULATION:

$$\text{VOC EMISSIONS} = U \times \text{Voc C} \times \text{RF}$$

U = Usage

Voc C = Voc Content

RF = Release Factor



VOC EMISSIONS OF CALENDAR PRINTING FOR THREE MONTHS

The data for VOC emissions can be seen in Table 4.1 below.

Material	Usage	Voc Content	Release Factor	Voc Emissions/ 3 Months
Ink	100 Kg	35% kg/Ltr	0.05	1.75 Kg
solvents	30 Ltr	0.70 kg/Ltr	0.5	10.5 Kg
fountain solution	20 Ltr	0.09 kg/Ltr	1	1.8 Kg
IPA(Isopropyl alcohol)	8 Ltr	0.80 kg/Ltr	1	6.4 Kg
Glue	30 Kg	35% kg	0.8	8.4 Kg

Table 4.1 Voc emissions of Calendar

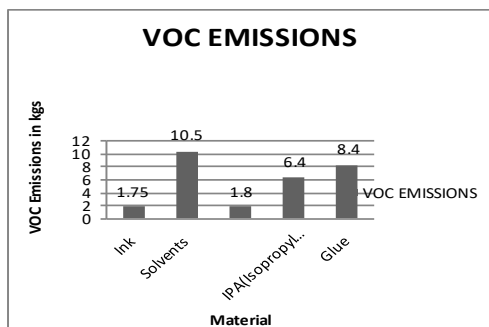


Figure 4.1 Voc emissions of Calendar

VOC EMISSIONS OF NEWSPAPER PRINTING FOR THREE MONTHS

Below Table 4.2 Includes the Voc Emissions released by the Newspaper printing

Material	Usage	Voc Content	Release Factor	Voc Emissions/ 3 Months
Ink	3070 Kg	35% kg/Ltr	0.05	53.725 Kg
solvents	45 Ltr	0.70 kg/Ltr	0.5	15.75 Kg
fountain solution	185 Ltr	0.09 kg/Ltr	1	16.65 Kg
IPA(Isopropyl alcohol)	45 Ltr	0.80 kg/Ltr	1	36 Kg
Glue	30 Kg	35% kg	0.8	8.4 Kg

Table 4.2 Voc Emission of Newspaper

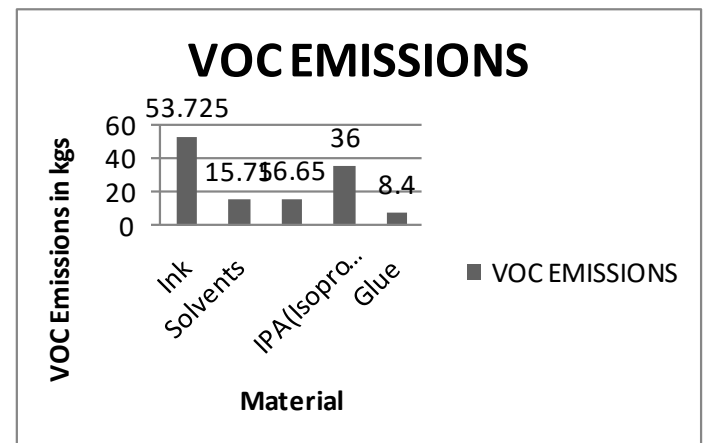


Figure 4.2 Voc Emission of Newspaper

B. CARBON FOOTPRINT

The name of the carbon footprint, which was developed by William E. Rees and Mathis Wackernagel in the 1990s from the ecological footprint concept. Ecological footprints were less focused than carbon footprints because carbon footprint measures purely emissions of gases that cause climate change into the Environment

CALCULATION:



Usage X Emission Factor = Carbon footprint

CARBON FOOTPRINT OF CALENDAR PRINTING FOR THREE MONTHS:

The carbon footprint of calendar printing is shown in Table 4.3

Procurement	Usage for 3 months	Emission Factor	CO ₂ e Emissions
Ink	100 kg	4.42 kg	442 kg
Paper	3750 kg	0.97 kg	3637.5 kg
Plate Making	14.2 kg	2.90 kg	41.18 kg
Electricity	118.3 kg	0.911 kg	107.7 kg
Wash up solvents	3.2 kg	0.98 kg	3.136 kg
Glue	30 kg	4.32 kg	129.6 kg

Table 4.3 Carbon footprint of Calendar

Procurement	Usage for 3 months	Emission Factor	CO ₂ e Emissions
Ink	3070 kg	4.42 kg	13569.4 kg
Paper	6,48000 kg	0.97 kg	62856 kg
Plate Making	14.2 kg	2.90 kg	41.18 kg
Electricity	148.03 kg	0.911 kg	134.85 kg
Wash up solvents	5.7 kg	0.98 kg	5.556 kg
Glue	30 kg	4.32 kg	129.6 kg

Table 4.4 Carbon footprint of Newspaper

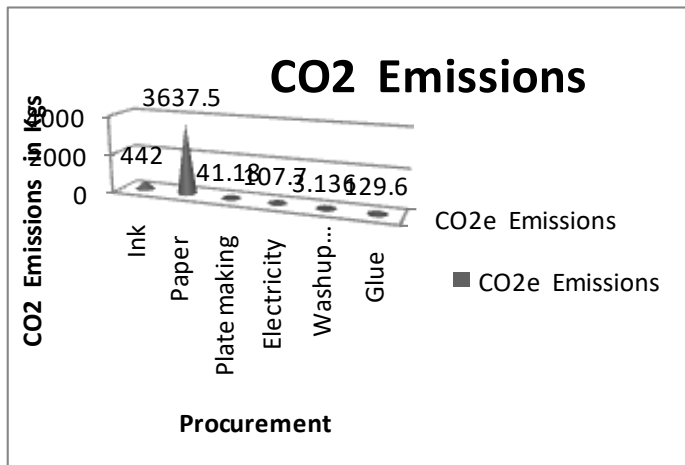


Figure 4.3 Carbon footprint of Calendar

Figure 4.4 Carbon footprint of Newspaper

CARBON FOOTPRINT OF NEWSPAPER PRINTING FOR THREE MONTHS:

Below Table 4.4 includes the Carbon footprint of Newspaper printing

C. WASTE MANAGEMENT

Waste management is one of the major environmental issues faced by printers today. Printing waste mainly occurs from solid wastes, Water waste, Air emissions. In modern waste reduction, Recycling is an important step and is the third



component of the environmental protection 3R (Reduce, Reuse, and Recycle).

Printing waste from three departments i.e., Pre-press, Press & Post-press was shown in the hierarchy:

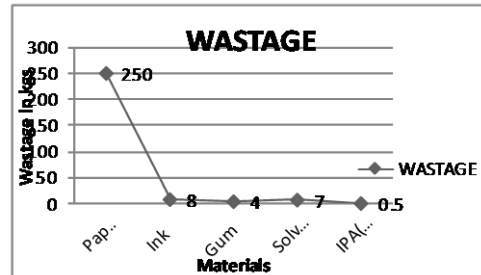
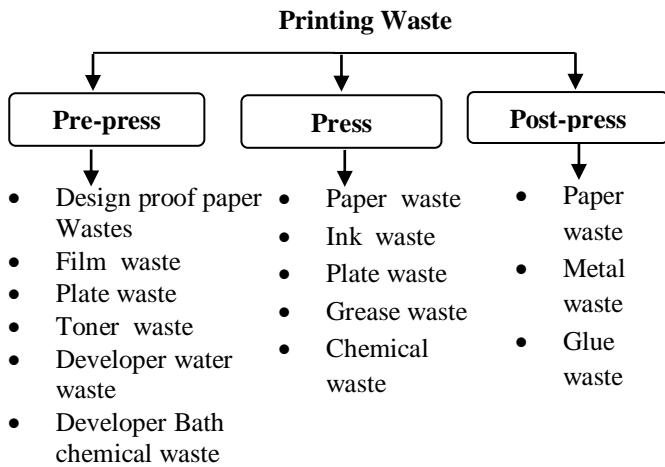


Figure 4.5 Wastage of Calendar printing

CALCULATION :

Usage X Wastage = Total Wastage

WASTE MANAGEMENT OF CALENDAR PRINTING

MATERIAL	USAGE	WASTAGE
Paper	3750 Kg	250 Kg
Ink	100 Kg	8 kg
Gum	30 Kg	4 kg
Solvents	30 Kg	7 kg
IPA (Isopropyl alcohol)	8 Kg	0.5 kg

FOR THREE MONTHS:

The data for the total waste over the 3 months which includes both hazardous, waste to landfill seen in Table 4.5 below:

Table 4.5 Wastage of Calendar printing

MATERIAL	USAGE	WASTAGE
Paper	6,48000 Kg	564.91 Kg
Ink	3070 Kg	195 kg
Gum	30 Kg	6 kg
Solvents	45 Kg	11 kg
IPA (Isopropyl alcohol)	45 Kg	6 kg

WASTE MANAGEMENT OF NEWSPAPER PRINTING:

Below Table 4.6 Includes the Wastage of Newspaper printing

Table 4.5 Wastage of Newspaper printing

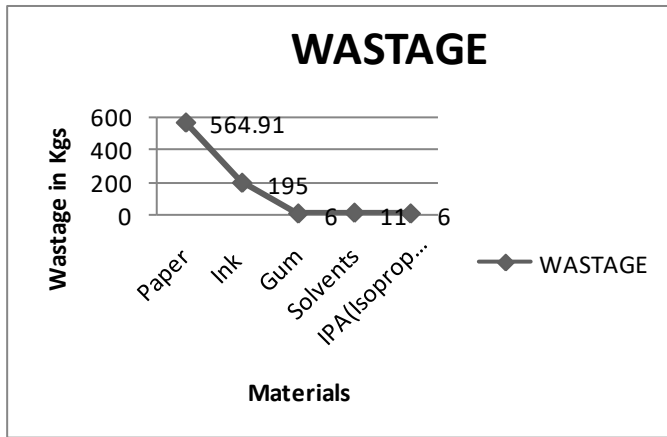


Figure 4.5 Wastage of Newspaper printing

V. RESULTS

Consumers of products from this industry should develop a positive attitude towards the environment and put pressure on producers to be able to meet up basic environmental requirements. Printing Industries should make use of environmentally friendly products in their production processes. Some of the environmentally friendly measures have been recommended in Table 5.1 below.

PRINT PHASE COMPONENTS	CFP	VOC	WASTAGE
Ink	Aqueous & Soy-based inks	Water & vegetable-based inks	Recycled-Contaminated ink Ink Disposal-uncontaminated ink.
Solvents	Eco-solvents	Use of solvents from biomass or plants which have No Vocs.	Low Wastage
Paper	Pulped Paper	Chlorine-free Paper	Recycle Paper & Reuse
Fountain Solution	Ecolity Solution	Non-Voc Ecolity solution	-
Adhesives	Compostable & Bio-degradable Adhesives	Repulpable adhesives	Recyclable Adhesives
IPA (Isopropyl Alcohol)	Crest Alchonov	Give low Volatile pressure	-

Table 5.1 Recommended guidelines

VI. CONCLUSION

Environmentally sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs.

In this study, we see a situation where there are fluctuations in environmentally friendly activities in two different presses.

For example, while the company was struggling to increase its use of environmentally sustainable paper and also to reduce its emissions of carbon dioxide, we notice a situation of drastic increases in the amounts of hazardous chemicals used in production. This, therefore, implies that companies need to



view their environmental sustainability situation as a whole made up of view their environmental sustainability.

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