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**IMPACT OF DIFFERENT ECO-FRIENDLY TECHNIQUES ON
ENVIRONMENTAL PERFORMANCE OF THE OFFSET PRINTING INDUSTRY**

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ABSTRACT

Environment and printing seems totally different fields but no any technological field can remain in isolation from other field at present time. Printers need to take extra care about environment because it is not only regulatory requirement but also socialresponsibility and hence requirement of industry. To comply with environment regulation, printers need to understand what impact industry has on environment. There are various materials, like ink, paper, plate, solvents and photographic film, are being used in offset printing machine. By the use of 3R technique that is reduce, reuse and recycle any organization can save money as well as environment. In this research work some eco-friendly techniques are suggested which can reduce the impact on environment at its minimum level. The environment impact of offset printing was examined before and after adopting those techniques.

KEYWORDS: Environment, Offset printing, VOC, Heavy metals, Pre-Press, Press, Post-Press.

I. INTRODUCTION

Offset Printing is one of the premier branches of printing field and over the period of time this field has seen tremendous changes; these changes include advancement of machine, substrate, ink and ancillary material. Some of the materials may be needed to improve the print quality but their excess use is hazardous for our environment. For the smooth and long run of business printers need to comply with environmental regulations. So there is strong need to monitor the environment impact and remedial measures which can be implemented to keep it in control. Organizations can save money and make their unit environment friendly by proper disposal of toxic waste material. Standards have been advised by The Environment (Protection) Rules, 1986 and industries need to keep their effluent discharge within permissible limits. For examining the environmental impact of the industry a study of offset printing unit was carried out to monitor environmental performance before and after implementing suitable techniques [1][2][3][4][5][6].

II. RESEARCH OBJECTIVES

Environment is one of the major point of concern for the printer because regulatory authorities are very strict they charge heavy penalty if any violation of guidelines is found besides conducting operations in environmentally responsible manner can enhance the goodwill and yield economic saving the objective of this work is to identify the point of wastage and to reduce them upto minimum level. To accomplish this objective this work was carried out.

The objective of this work is:-

- To examine the impact of different eco-friendly techniques on environmental performance of the offset printing industry.

III. RESEARCH METHODOLOGY

The method used to carry out the research was experiment/observation based. A local printing press situated in Hisar was selected where changes were being examined. Different points were identified in production chain /cycle where wastage was being done. After identifying the points the air quality of the press room and the water being discharged from the press was measured by taking help of environment scholar. The data was collected for 15 days and then the steps/measures to reduce the wastage were discussed among all the staff and its

importance in term of economy, regulatory requirement and on the health of staff. Again after one month the air and water samples were taken from the press for 15 days .This work shows that small changes in working method and slight change of attitude towards work can bring a great effect because besides the quality of raw material, awareness of staff is equally important. The eco-friendly techniques used in pre-press to post-press are shown in Table.1.

Table.1. Eco-friendly Techniques used during examination period

Sr. No.	Pre-Press	Press	Post-Press
1.	Scrap films, Aluminium plates were sent to vendor for recycling.	Checked paper and ink compatibility before printing	Use of accurate size paper to reduce cutting waste
2.	Covering of chemical cans to prevent contamination and emissions	Establishing schedule for cleaning of different units	Use water based adhesive and older adhesive first
3.	Treatment of photo chemicals before discharging.	Put enough ink into ink duct to reduce initial wastage	VOC exhaust techniques
4.	Use of chemicals up-to active life.	Use of optimum IPA in dampening	Sending wrap, cures, scrap and trimmed paper for recycling
5.	Use of Non-hazardous plate developer.	Eliminate toxic cleaners	Use of mechanical binding in place of chemical adhesive binding
6.	Kept temperature of section below 18 degrees.	Use of pre-used towels for initial cleaning	Solid and Liquid waste treatment

IV. DATA COLLECTION AND ANALYSIS

Table.2. General Emission Standards and their comparison before and after study

Sr.No.	Parameter	Std. Concentration not to exceed(in mg/Nm ³)	Before	After
1	Particulate matter(PM)	150	165	145
2	Total fluoride	25	28	24
3	Asbestos	4 Fibres/cc	6 Fibres/cc	5
4	Mercury	0.2	0.25	0.17
5	Chlorine	15	20	14
6	Hydrochloric acid vapour and mist	35	42	34
7	Sulphuric acid mist	50	54	50
8	Carbon monoxide	1%	1.2	0.90%

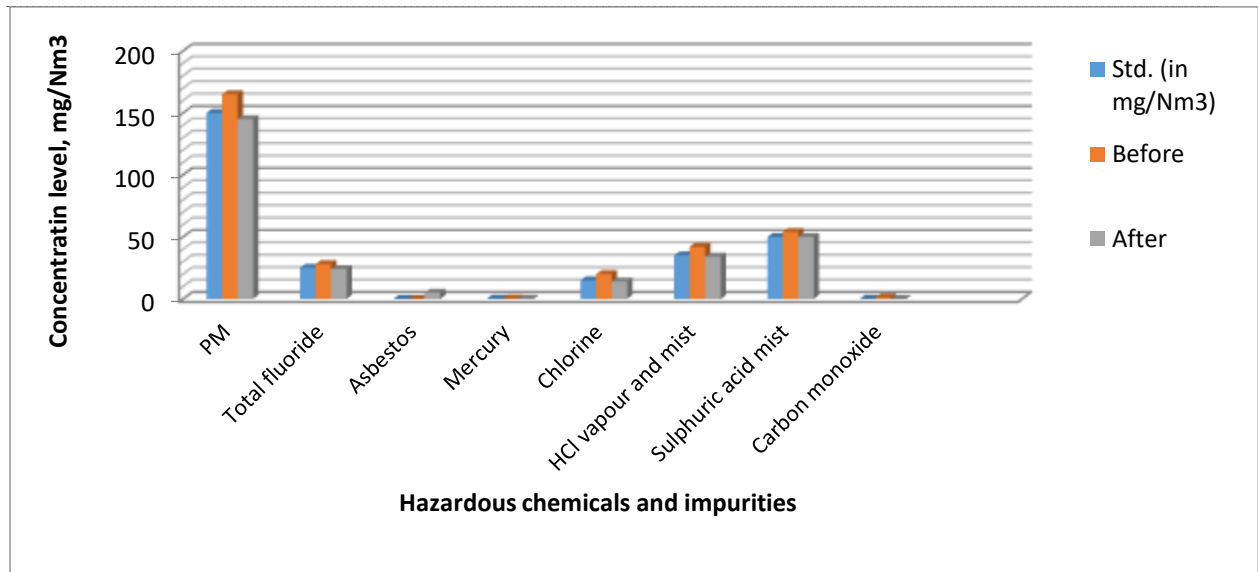


Fig.1. Analysis of General Emission Standards and their comparison before and after study

Table.3. General Standards for discharge of Effluents and their comparison before and after study

Sr.No.	Effluent Particles	Std. for discharge of Effluents	Before	After
1	Suspended solids mg/l,max.	600	800	570
2	pH value	5.5-9.0	8.5	6.5
3	Oil and grease, mg/l,max.	20	27	18
4	Mercury mg/l,max.	0.01	0.02	0.01
5	Lead mg/l,max.	1.0	1.3	1.0
6	Cd mg/l,max.	1.0	1.5	0.95
7	Chromium mg/l,max.	2.0	2.45	1.90
8	Copper mg/l,max.	3.0	3.5	2.80
9	Zinc mg/l,max.	15	18	14
10	Nickel mg/l,max.	3.0	3.4	2.90
11	Manganese mg/l,max.	2	2.65	2.0
12	Iron mg/l,max.	3	3.2	3.0

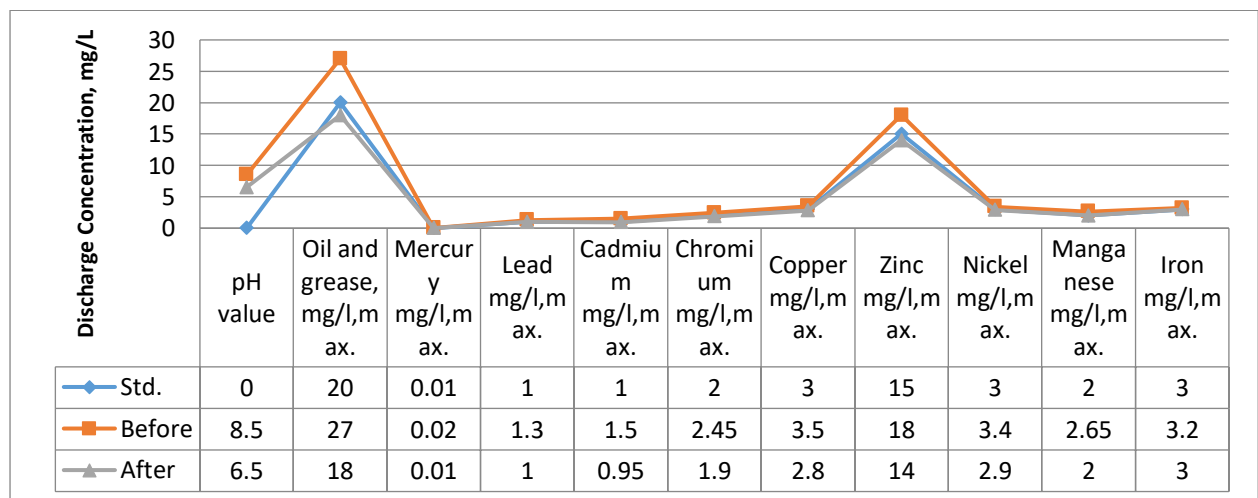


Fig.2. General Standards for discharge of Effluents and their comparison before and after study

Table.4. Use of resources comparison before and after study

Sr.No.	Parameter	Consumption before study	Consumption after study
1	Paper (in tonnes)	103	100
2	Ink (in kg)	590	574
3	Fountain solution (litre)	255	240
4	Washing chemical (litre)	335	310
5	Plate (nos.)	580	565
6	Developer (in kg.)	21	19
7	Fixer (in kg.)	22	20
8	Lacquer (in kg.)	49	47

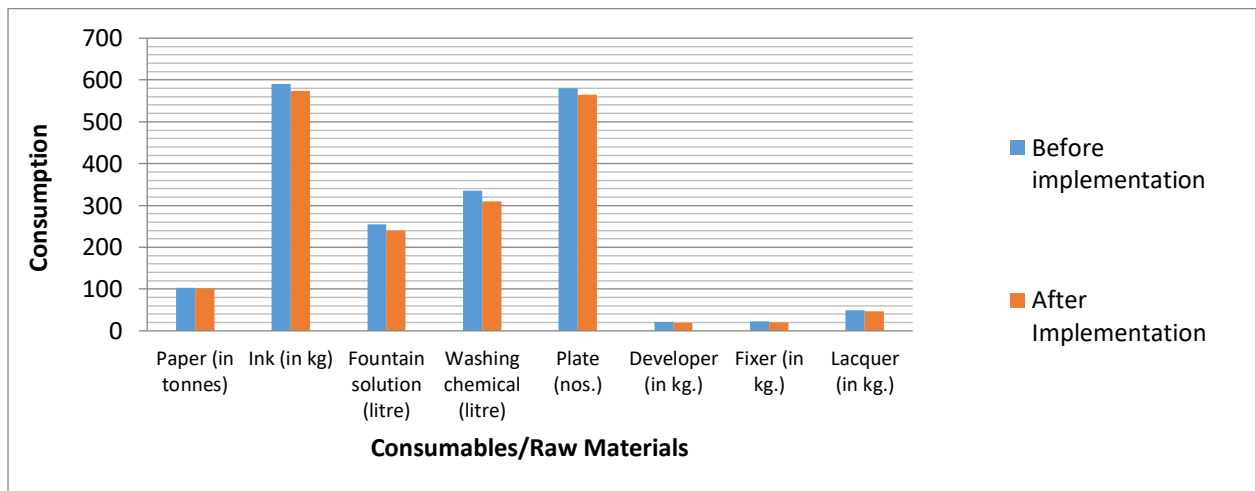


Fig.3. Use of resources comparison before and after study

V. RESULT AND DISCUSSION

a. Impact on PM concentration in Air

Concentration of particulate matter in the air was 165 mg/Nm^3 before implementation of eco-friendly techniques and after the implementation this concentration falls to 145 mg/Nm^3 which is within standards i.e. 150 mg/Nm^3 . So it is resulted that mentioned techniques have very positive impact in reducing pollution in terms of reduced PM concentration (Table.2. Fig.1.).

b. Effect on Heavy metal discharge

Heavy metals are very hazardous if consumed directly or indirectly through air, soil or water. In printing industry also heavy metals like Lead, Zink, Nickle, Copper and Chromium are used in different ways from pre-press to post-press. So it was resulted that with the applications of eco-friendly solutions heavy metal discharge was substantially reduced as shown in Table.3, Fig.2.

c. Effect on effluent discharge

During production, cleaning and maintenance work the liquid and gaseous hazardous waste are discharged by the printers but they are unaware about their adverse effect on ecology. When the eco-friendly strategy were put into action, the effluent discharge was reduced as shown in Table.4. , Fig.3. Printers were quite satisfied with the outcomes exhibited by eco-friendly solutions.

d. Impact on Wastage of Raw Materials

Raw material contributes to 60 % cost of whole print production and its wastage is very alarming concern among printers. The suggestions given were found very helpful in reducing wastage of raw material like paper, ink, solvents, dampener, developer, washing chemicals etc. The wastage was reduced 3%-7% by adopting eco-friendly techniques in the pressroom by workmen.

e. Further suggestions for printers

Further it is worth mentioning that printers are suggested to reduce VOC emissions, effluent discharge and solid wastes by facilitating fabric filter, electrostatic precipitator, solvent recovery mechanisms, activated carbon cartridge etc.

VI. CONCLUSION

Many important findings revealed of this work and following conclusion are drawn:

1. Particulate matter (PM) concentration in air can be reduced to standard level by putting extra attention to mentioned eco-friendly techniques and same can learnt to the pressroom workers to reduce environmental impact.
2. Heavy metal emission can be reduced significantly by adopting eco-friendly solutions suggested for liquid discharges.
3. pH value of discharge can be can be reduced upto non-hazardous level.

Wastage of raw materials can be reduced from 3%-7% by applying eco-friendly methods resulting in saving of product cost and environment both.

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