

“CURRENT ENVIRONMENTAL CONDITIONS, HEALTH AND SAFETY MEASURES IN FLEXO AND GRAVURE PRINTING INDUSTRY IN INDIA”**Deepak Kumar Sharma¹, Ambrish Pandey², Jitender Pal^{3*}**Department of Printing Technology^{1,2}, Department of Environment Science & Engineering³
GJUS&T University, Hisar, HaryanaCorresponding Author*: Email: j_pal2k1@yahoo.com**ABSTRACT**

The objective of this study was to investigate the industrial environmental conditions, health & safety measures in gravure, flexography printing processes and highlights the current environmental practices followed, while performing various operations in these printing processes. This study was conducted in four pre-identified gravure and flexography printing industries in India. A visually monitored research study was conducted to know about the environment conditions, health & safety measures at the industries. The selected printing industries (P, Q, R, and S) are kept confidential.

KEYWORDS: VOCs, IAQ, Pre-Press, Press, Post-Press.**INTRODUCTION**

Printing is one of the human race's most far-reaching cultural achievements and a medium that is ideally suited to our senses. As the first means of mass communication, paper opened up a world of information and education to huge swathes of the population. Because print, has been necessary for businesses throughout history, the printing industry has been an integral part of life. A large number of innovations have changed the operations of the printing industry (Jensen, K. B., (2022). Whereas printing was originally handwork, controlled by the printer, the introduction of the printing press made it an industrial process. Child, J. (2021). Today, printing and digital media complement one another and are spawning new applications. Printed material is easy to handle; it can explain, entertain, provide guidance, and appeal to feelings. And it is highly likely that some of the products you hold in your hands every day have been printed on printing presses.

MATERIALS AND METHODS

This research study is carried out in four different printing industries in India named as P, Q, R, and S. The names of printing industries are kept confidential because workers have consented to take part in the study on this condition that no personal information of their and their industries will be published anywhere else without asking their permission. That's why the names of the printing industry are denoted as P, Q, R, and S. These printing industries are selected on the basis of their production range. The printing industries which have production range more than 100 ton/ year are selected for this study. The printing industries use chemicals (inks, lacquers, adhesives, cleaning solvents, and other chemicals). To collect the data, a visual monitoring scale is used which asked about current environmental practices followed and working experience in the workplace for more than one year. The data is analyzed using statistical tools or statistical software. A visual examination of the areas and personal

discussion with printing industries workers was also included as an optional environmental monitoring tool in addition to the collection of primary data using a questionnaire.

RESULTS AND DISCUSSION

- 1) Visual Monitoring Scale of Industrial Environmental Conditions, Health & Safety Measure Assessed by Visual Inspection: In basic industrial environmental conditions, health & safety measure assessment of the pre-identified four printing industries visual monitoring was done. A scale was devised from 0 to 4. The scale ranges from 0 to 4 (0 = very low, 1= low, 2= good, 3 = very good and 4 = excellent). The scale points were given on the basis of industrial environmental condition, health and safety measures. 'P' industry is having good condition for industrial environmental, health and safety measures that's why it is graded as '3'. It has pollution controlling device and paying attention on workers for their health and safety measure that's why it is graded as '3'. 'Q' and 'S' industry have very good environmental condition that's why it is graded as '3' and giving less emphasis on workers for their health and safety measure that's why it is graded as '2'. 'R' industry was not having good condition for industrial environmental that's why it is graded as '2' but it was paying attention on workers for their health and safety measure that's why it is graded as '3' (Shown in table 1).

Table 1: The printing industries assessed by visual inspection

Printing Industries	Industrial Environment Conditions	Health & Safety Measures
P	3	3
Q	3	2
R	2	3
S	3	2

Four grades were devised ranges from A to D (A = excellent, B = very good, C = good, D = poorest) for assessment of water supply and environment conditions of four pre identified industries. Daily cleanness is done, Color coded dustbins were used for solid, semi- solid pollutants in solid waste management, RO's water for drinking and ground water for washing purpose and air pollution controlling device were used that's why the vicinity of all the four selected printing industries came under Grade 'B' (Shown in table 2).

Table 2: Water supply and Environmental Conditions

Grade	Water Supply	Environment Conditions
A	Drinking water is available with excellent quality of water	Excellent cleanliness, solid waste management, waste water management, air pollution controlling device
B	Drinking water with some guarantee of its quality	Very good cleanliness, solid waste management, waste water management and air pollution controlling device

C	Ground water available with Unknown quality	Good cleanliness, solid waste management, waste water management and air pollution controlling device
D	No water supply	Poorest cleanliness, solid waste management, waste water management and air pollution controlling device

Safety Measures

The following should be included in standard safe work practices to lessen the workers health safety issues: Printing inks of solvent based can be replaced by vegetable-based inks (including soy oil-based inks) or aqueous-based inks, due to health and safety concerns, as well as environmental consideration (Gomes da Silva et.al, 2020). Printing techniques and tools can be changed to reduce VOC emissions and the dangers associated with hazardous materials. Equipment, material application techniques, and process systems can all be altered or changed (Aydemir, C., and Özsoy, S. A. (2020). To eliminate the need for manual cleaning and reduce worker exposure to organic solvents, automated blanket washers are installed in some printing machines (Kliopova-G, I., and Kliaugaitė, D. (2018). In order to clean rollers, employees often dip a sponge or cleaning cloth into a cleaning solution container that is always left open (Zhang, Z., et.al., 2021). In reality, similar task can be facilitated without the negative effects of solvent vapor by using a spring-loaded plunger. Adopting the proper preventive measures is the main thing to think about in order to eliminate or substitute the hazards at their source (Prica, M., et.al, 2016). Restricting the time spent of workers to the danger, Storing printing inks and solvents in closed containers when not in use, avoiding skin contact with solvents and printing inks (Kiurski, J. S., et.al., 2016). The main goal of employing protective equipment is to shield the skin or clothes from contact with dangerous substances and stop contamination from spreading (Karim, N., et.al., 2020). Employees should always wear appropriate protective clothes while working with printing inks or solvents, including dispensing, storing, and performing maintenance (Pohanish, R. P., 2017). Additionally, employers must to supply emergency apparel to their staff.

CONCLUSION

As per research and findings, this study will help the industry and society by making aware them about the current environmental practices followed in flexo and gravure printing industries in India. The causes of poor environmental conditions are due to inadvertent handling of things without sufficient management. Environmental condition could be better by ensuring that their workers fully understand the hazards at work and that the work practices may help them execute their duties safely after analyzing the dangers in the workplace and implementing suitable preventative measures. Employees should get the necessary safety knowledge, training, and guidance to accomplish this.

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