

The Analysis of Occupational Safety and Health of the Batik Industry

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Abstract. Occupational safety and health is an important issue in an operational process, both in traditional and modern sectors. Prevention of work accidents can be done by knowing the risks that exist in a process, one of them is through Hazard Identification, Risk Assessment, and Risk Control (HIRARC) methods. In the batik industry, batik makers come into direct contact with materials containing hazardous chemicals and uncomfortable work positions. In addition, the craftsmen also do not care for the environment and do not use personal protective equipment. The purpose of this study is to determine the factors of occupational safety and health. This purpose also to use of personal protective equipment while working and identify potential hazards in the batik production process in the batik industry of Sekar Arum and Mahkota Laweyan. Factors causing occupational accidents include an unsafe batik environment, unsafe equipment, containing hazardous substances and unsafe work attitudes. In addition, the lack of orderly use of personal protective equipment in the form of boots, gloves and aprons. Based on the findings of the hazard, it is known that there are hazards with low category namely in the *nyanting* room, washing and drying rooms, and the waste management room with hazard percentage is 10,26 %, medium category namely in the stamp room with hazard percentage is 30,77 % and high category namely the coloring room with hazard percentage is 38,46 %.

Keywords: Personal Protective Equipment; HIRARC; Occupational Safety and Health

1. Introduction

The batik industry an important role in national economic growth. The sector, which is dominated by small and medium industries, is able to contribute significantly to the country's foreign exchange from exports. According to the ministry of industry, the export value of batik and batik products until October 2017 reached USD 51.15 Million. Along with the increasing demand for batik and batik products, the batik industry is demanded to increase its productivity in order to meet the demand with good quality.

Surakarta is one of the batik producing cities in Indonesia. One of the places that can be visited is Batik Sekar Arum and Mahkota Laweyan in Laweyan Village, Surakarta. In this place there are several batik making processes that take place, namely the process of cutting cloth, stamp, coloring, drying, and arranging batik cloth. The process is almost entirely done manually. Because it is done manually, humans have a very important role in the sustainability of the production process. But humans have limitations, so in carrying out their work humans can make mistakes. And the lack of

human awareness on occupational safety and health so that the potential to cause accidents due to work.

Occupational safety and health an attempt and thought to guarantee the integrity and perfection of both physical as well as spiritual human beings in general and of labor in particular, along with the result of his work in the community toward a just, prosperous and peace [1]. How to cope with work accidents is by eliminating the elements causing the accident or holding strict supervision. In batik industry Sekar Arum and Mahkota Laweyan there are several types of chemicals that have the potential to cause occupational hazards and accidents, most workers do not use any personal protection so they come into direct contact with these chemicals. Therefore, workers must know the hazards they face while working and can prevent them.

The final goal to be achieved in this study is to determine the factors of occupational safety and health and the use of personal protective equipment when working together to identify potential hazards in the batik production process in the batik industry of Sekar Arum and Mahkota Laweyan.

2. Methods

This research was carried out in the batik industry of Sekar Arum and Mahkota Laweyan in Laweyan village, Surakarta. This research began in September - November 2019. Data collection was carried out by direct observation in the production area, interviews with workers and literature study.

This research uses the HIRARC method. Process of HIRARC requires 4 simple steps, there are classify work activities, identify hazard, conduct risk assessment and decide if risk is tolerable and apply control measures [2]. The first step in research is classify work activities. This step is classify geographical or physical area include outside premises, stages in production or service process and defined task of work. Next step is identify hazard. This is process of examining each work area and task for purpose of identifying all the hazards which are inherent in the job. The next step is risk assessment. Risk assessment is process of evaluating the risks to safety and health arising from hazards at work. The purpose of the risk assessment process is to remove a hazard or reduce the level of its risk by adding precautions or control measures, as necessary. For risk analysis that uses likelihood and severity in qualitative method, presenting result in a risk matrix is a very effective way of communicating the distribution of the risk throughout a plant and area in a workplace [3]. In mathematical term, risk can be calculated by the equation :

$$\text{Risk (R)} = \text{Likelihood (L)} \times \text{Severity (S)} \quad (1)$$

Here is the table of likelihood and severity of the risk :

Table 1. Likelihood Value

Likelihood (L)	Example	Rating
Most likely	The most likely result of the hazard / event being realized	5
Possible	Has a good chance of occurring and is not unusual	4
Conceivable	Might be occur at sometime in future	3
Remote	Has not been known to occur after many years	2
Inconceivable	Is practically impossible and has never occurred	1

Table 2. Severity Value

Saverity (S)	Example	Rating
Catastrophic	Numerous fatalities, irrecoverable property damage and productivity	5

Fatal	Approximately one single fatality major property damage if hazard is realized	4
Serious	Non-fatal injury, permanent disability	3
Minor	Disabling but not permanent injury	2
Negligible	Minor abrasions, bruises, cuts, first aid type injury	1

Based on table 1 and table 2, can determining the level of risk. This to find out any risk that requires immediate treatment based on the risk assessment. this determination was based on the risk assessment matrix is divided into 3 categories, there are low risk, medium risk and high risk. here is the matrix of risk assessment. Here is the matrix of risk assessment at Table 3.

Table 3. Matrix of Risk Assessment

Likelihood (L)	Saverity (S)				
	1 Negligible	2 Minor	3 Serious	4 Fatal	5 Catastrophic
5 Most likely	5	10	15	20	25
4 Possible	4	8	12	16	20
3 Conceivable	3	6	9	12	15
2 Remote	2	4	6	8	10
1 Inconceivable	1	2	3	4	5

 = High  = Medium  = Low

The relative risk value can be used to prioritize necessary actions to effectively managework place hazards. Table 4 determines priority based on the following ranges:

Table 4. Level of Risk

Risk	Description	Action
15-25	High	A HIGH risk requires immediate action to control the hazard as detailed in the hierarchy of control. Actions taken must be documented on the risk assessment form including date for completion.
5-12	Medium	A MEDIUM risk requires a planned approach to controlling the hazard and applies temporary measure if required. Actions taken must be documented on the risk assessment form including date for completion.
1-4	Low	A risk identified as LOW may be considered as acceptable and further reduction may not be necessary. However, if the risk can be resolved quickly and efficiently, control measures should be implemented and recorded.

3. Results and discussion

The work accident that was experienced by the batik industry of Sekar Arum and Mahkota Laweyan was a fire. The fire that occurred was caused by a candle heating stove. Based on interviews with workers it is known that workers already understand how to extinguish the fire.

The Sekar Arum and Mahkota Laweyan batik industries have never done disaster management simulations to their workers. So that workers do not yet have the provision of knowledge in case of disasters such as severe fires, earthquakes, explosions and other disasters. In addition, the two industries have not yet carried out regular health checks on their workers. So the health impacts arising from work cannot be measured and the health of workers is also not guaranteed.

The following is Hazard's findings in the batik making area, as in Table 5 .

Table 5. Hazard in Batik Industry Area

Location	Hazard's Finding	Risk	Risk Analysis				Hazard Percentage
			L	S	R	Category	
Nyanting Room	Workers exposed to hot candles and candle steam	Redness of the skin when exposed to hot candles and dizziness and shortness of breath if hot candle steam is inhaled	4	1	4	Low	10,26 %
Coloring Room	Workers exposed to coloring agents (naphthol) and NaOH, NaNO ₂	If exposed to the skin can cause skin irritation to festering. If inhaled will cause dizziness and shortness of breath. And can cause slipping.	5	3	15	High	38,46 %
Washing and Drying Room	Pekerja terkena zat pewarna (naftol) dan NaOH, NaNO ₂	If exposed to the skin can cause skin irritation. If not careful can slip	4	1	4	Low	10,26 %
Waste Management Room	Workers exposed to heating flames, hot candle steam, and puddles of waste water	There is a fire and can slip	4	1	4	Low	10,26 %
Stamp Room	Workers exposed to	Redness of the skin when exposed to	4	3	12	Medium	30,77 %

hot candles and candle steam	hot candles and dizziness and shortness of breath if hot candle steam is inhaled
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From the findings of the hazard it is known that there are hazards with low category namely in the nyanting room, washing and drying rooms, and the waste management room with hazard percentage is 10,26 %, medium category namely in the stamp room with hazard percentage is 30,77% and high category namely the coloring room with hazard percentage is 38,46%. The following is a hazard level column chart presented in Figure 1 below:

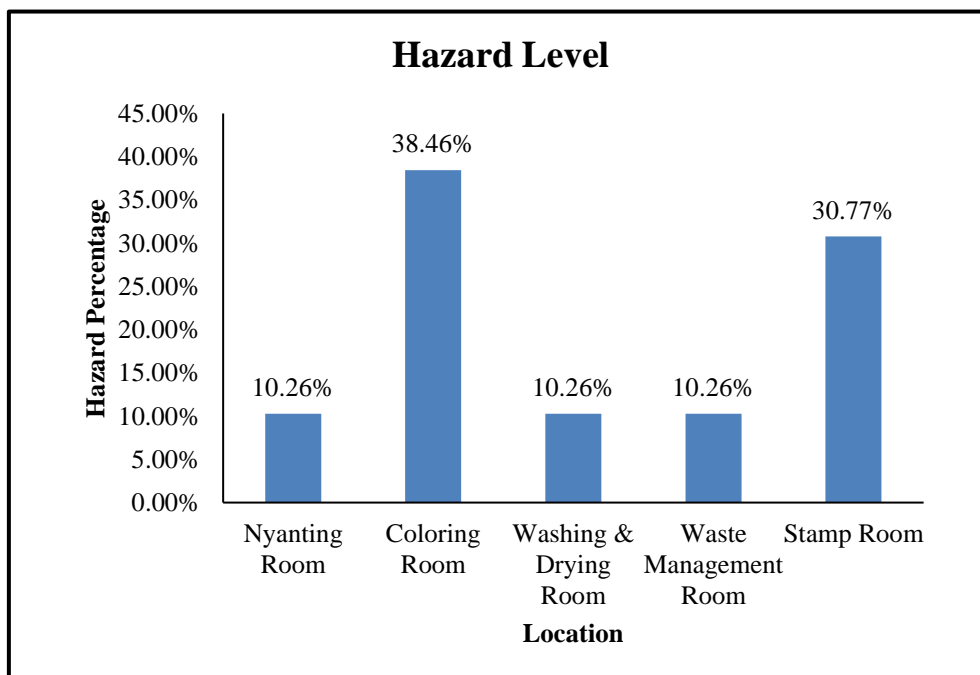


Figure 1. Hazard Column Chart

The identification of hazards and risk in the batik industry of Sekar Arum and Mahkota Laweyan can be explained in detail about the deviations that might occur in Table 6.

Table 6. Identification of hazards and risks in the batik industry

Process	Deviation	Consequences	Cause	Suggested action
Batik or Nyanting	Workers do not use masks and gloves	Exposure to hot steam inhalation and burns if exposed to hot candles.	Personal Protective Equipment is available but workers do not use it and workers do not understand the hazards of chemicals to the body	Make visual displays so workers understand the hazards of candle candles and their mixtures.
Coloring	Workers do not	Exposure to	Workers do not	Provides adequate

	use a personal protective equipment	inhaled dyes. Skin irritation due to body exposure to dyes. Slipping if exposed to dye splashes	understand the hazard of coloring substances (naphthol) for the body and the environment	personal protective equipment and makes a visual display and provides a shelter for dyes (naphthol)
Washing and Drying	Do not wear gloves and footwear, the dye is not managed properly	Skin irritation due to body exposure to dyes. Slipping if exposed to dyes and washing water	Workers do not understand the hazard of coloring substances (naphthol) for the body and the environment	Provides personal protective equipment and makes a visual display so workers understand work safety
Waste treatment	Do not wear gloves and footwear, waste is not managed properly	Skin irritation due to body exposure to dyes. Slipping if exposed to dyes and washing water	Workers do not understand the hazard of coloring substances (naphthol) for the body and the environment	Provide personal protective equipment and make a visual display so that workers understand the safety of work and waste storage
Stamp	Not wearing adequate heat and body protection gloves	Exposure to hot steam inhalation and burns if exposed to hot candles	Workers do not understand the hazard of coloring substances (naphthol) for the body and the environment	Provides personal protective equipment and makes a visual display so workers understand work safety

Based on the data obtained then analyzed based on direct observations, interviews, and evaluation of potential hazards, recommendations for occupational safety and health standards for the Sekar Arum and Mahkota Laweyan batik industry are given as follows, the layout of the factory is made with the appropriate distance between the combustion tool, fuel and fabric production. Install an alarm as an information system. This alarm is useful as a sign or warning that a disaster has occurred so that the owner or worker can save themselves and overcome the disaster. Conducting activities that maintain and empower the quality of a good work environment, such as cleaning the entire factory and surroundings. Repairing equipment that is not feasible to use as well as making adequate waste disposal channels so as not to be scattered on the floor. Procurement of personal protective equipment and checking the availability of PPE periodically. Conducting inspection and evaluating the feasibility of the factory where it works as well as knowing the discipline of workers at work and in the use of personal protective equipment that supports while working. Conduct regular health checks for workers to be able to monitor the condition of workers or occupational diseases.

4. Conclusion

Factors causing occupational accidents include an unsafe batik environment, unsafe equipment, dyes containing hazardous substances and unsafe work attitudes. In addition, the lack of orderly use of Personal Protective Equipment in the form of boots, gloves and aprons. Based on the findings of the hazard, it is known that there are hazards with low category namely in the nyanting room, washing and drying rooms, and the waste management room with hazard percentage is 10,26 %, medium category namely in the stamp room with hazard percentage is 30,77 % and high category namely the Coloring room with hazard percentage is 38,46 %. Suggested improvement is to conduct training and

counseling to workers in the Sekar Arum and Mahkota Laweyan batik industry on occupational safety and health on a regular basis. This training is expected to increase workers awareness of occupational safety and health hazards and use of personal protective equipment while working. In addition, as soon as possible to control the potential sources of hazards and take action to control the risk of work accidents. And increasing the number of available personal protection equipment that meets the standards, so that enough for workers. The owner of the batik industry must carry out regular supervision of workers in using personal protection equipment.

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