



Assessment of Potential Hazards with Job Safety Analysis on Workers at Cotton and Gauze Industry

Demes Nurmayanti, Puteri Jasmine Annisa, Pratiwi Hermiyanti, Winarko

Department of Environmental Health, Poltekkes Kemenkes Surabaya, Surabaya, Indonesia
demes@poltekkesdepkes-sby.ac.id

Abstract. Job safety analysis (JSA) is an attempt to identify potential hazards in the industrial stages of labor to prevent the risk of work accidents. This research aims to analyze the potential of physical, chemical, and mechanical hazards in the production labor of the cotton and gauze industries by 2022. This research employs a descriptive-qualitative approach and focuses on the production supervisors, production management officers, and production workers in the cotton and gauze industry. The data collection was conducted by applying interviews, observation, and documentation by examining hazard risk and risk control variables. The data obtained were analyzed using the AS/NZS 4360 matrix, and the results will be in the form of diagrams, tables, etc. According to the results of the identification of potential hazards in the production area of the cotton and gauge industry, 104 physical hazards, 24 chemical hazards, and 3 mechanical hazards were found. From these potential hazards, a risk assessment was carried out, and the results obtained were very low risk, as many as 7 (13%) risks, low risk, as many as 23%, moderate risk, as many as 30%, high risk, as many as 9%, and very high risk, as many as 25%. To prevent these potential hazards from endangering workers, control efforts are carried out using the risk control hierarchy method, which includes the use of PPE, administrative, and technological engineering efforts.

Keywords: Job Safety Analysis, Work Accident, Hazard

1 Background

Occupational safety and health (OSH) is one way to establish a workplace that is safe, healthy, free from environmental pollution and increase the highest degree in workers in all types of work, so that worker productivity can increase because the workplace is protected and free from work accidents[1]. Work accidents can be caused by lack of experience because they tend to behave unsafely, pay less attention to work environment conditions, are careless, and lack discipline[1, 2].

The effort to reduce the accident rate is to analyze occupational safety using risk management methods. In Indonesia, there are several occupational safety and health risk management methods used such as Hazard Identification, Risk Assessment, and Risk Control (HIRARC), Hazard and Operability Study (HAZOP), and Job Safety Analysis. JSA or Job Safety Analysis is an way to analyze tasks and procedures in the

industry. From the three risk analysis methods, JSA method with the HIRARC method with the aim of reducing the number of work accidents in workers at a mild steel factory in East Java [3–5]. The results of the study showed that the JSA method has a significant effect on the prevention of work accidents compared to the HIRARC method so that the use of this method is less significant for the prevention of work accidents [6–9].

Job safety analysis (JSA) is a method of analyzing a job to identify hazards and potential incidents associated with each step, developing solutions that can eliminate and control hazards and incidents. The purpose of JSA is to identify potential hazards, assess the level of risk, and evaluate the steps that have been taken to control the risk [10, 11]

Basically, there are four steps to conduct JSA, which are selecting jobs with priority work activities that have the highest accident cases or high potential hazards, the next stage determines the sequence and steps of work, if a job has been carried out routinely by the company, then this step can be done by carrying out field observations when workers carry out these activities. The third steps identify and analyze the hazards for each work step. Identifying all possible hazards that exist in each work step must be identified, which requires accuracy and foresight from the analysis team. And the last step is to determine prevention and control efforts against hazards and potential hazards so that accidents do not occur [8, 11, 12].

One of methods that can be used to prevent and control hazards and potential hazards in the work environment is the hierarchy of risk control which is in compliance with the rules in the Minister of Manpower Regulation Number 5 of 2018. The regulation states that the hierarchy of risk control includes elimination, substitution, engineering controls, administrative controls and personal protective equipment [13, 14]

The aim of this research is to assess the potential physical, chemical, and mechanical hazards and their hazards sources for production workers in the cotton and gauze industry in 2023, as well as to assess and control each hazard risk.

2 Research methods

The method used in this research is descriptive qualitative research that describes the results of the analysis of potential hazards in a work process using the cross sectional observational method using Job Safety Analysis and AS/NZS 4360 tools at the work process steps of saponification, bleaching, fat washing, neutralization, centrifuge, rolling, and cutting cotton and gauze in the cotton and gauze industry production division [15] Descriptive qualitative research data collection is carried out in natural settings (natural conditions), primary data sources, data collection techniques more on observation, in-depth interviews, and documentation.

The research is located in the cotton and gauze manufacturing industry located in East Java. The subjects of this research are production supervisors, production management officers and production workers in the cotton and gauze manufacturing industry. While the object of this research is the operational standards in the production process activities in the cotton and gauze manufacturing industry. The research variables in this

research include hazard sources, potential physical hazards, risk assessment, and risk control.

The analysis method used is qualitative descriptive analysis. Qualitative descriptive analysis uses the JSA worksheet reference, then a risk assessment is carried out using the AS/NZS 4360 matrix to determine the amount of risk level on the job. Data that has been obtained from interviews, observations, JSA Worksheet document reviews, and AS/NZS 4360 matrices is processed and uses data depiction in the form of diagrams, tables, and the like [15, 16].

Data sources in this research include observations of the work process, documentation results, in-depth interviews with informants and Job Safety Analysis (JSA) sheets based on the Job Safety Analysis book [8, 12, 17].

2.1 Scoring criteria

Potential Hazard Assessment. Existing, if there are potential physical, chemical and mechanical hazards. None, if there are no potential physical, chemical and mechanical hazards.

Hazard Risk Level Assessment. 1) The criteria for assessment of the level of hazard risk based on the AS/NZS 4360 risk matrix assessment are as below [15]: 2) It is called Very Low if the risk level is $1 - \leq 5$. 3) It is called Low if the risk level is $6 - \leq 11$. 4) It is called Medium if the risk level is $12 - \leq 15$. 5) It is called High if the risk level is $16 - \leq 19$. 6) It is called Very High if the risk level is $20 - \leq 25$ [15, 16]

3 Results and discussion

Hazard identification in the Cotton and Gauze Production Area is carried out using the Job Safety Analysis (JSA) method. JSA is carried out based on production activities. Hazard identification is based on observations and interviews in the production area. In general, several potential hazards were found in the production area, including:

3.1 Hazard Source

Sources of hazards in the workplace can come from a variety of factors, including humans, production equipment, production materials, production processes, and systems and procedures. From these various factors, hazards that threaten workers can arise. The following are various sources of hazard that researchers can identify in the cotton and gauze industry production area:

Table 1. Hazard Source Analysis in The Cotton and Gauze Industry Production Area

Hazard Source	Description
Humans	Workers in the cotton and gauze production area
Equipment Production	Pulley, Blending Machine, Packing Machine, Press Packing Machine, Cotton Affrol and Offroll Machine, Cotton Cutting Machine, Cook Kettle, Gauze Cutting Machine, Press Machine, Centrifuge Machine
Production Process	Saponification process, Bleaching process, Fat washing, Neutralization, Blending, Rolling, Cutting.
Production Materials	KOCl, marlon, HCl, H ₂ O ₂ , Upitek, Na ₂ SiO ₃ , NaOH, C ₃ H ₈ O
Systems and Procedures	-

Based on Table 1, it was observed that in the production area of the cotton and gauze industry, there are several sources of hazards found which originate from humans, production equipment, production processes, production materials, and systems and procedures. Hazards coming from humans come from workers in the cotton and gauze production area. Hazards coming from production equipment come from blending machines, packing machines, packing press machines, cotton affrol and offroll machines, cotton cutting machines, cooking kettles, gauze cutting machines, press machines, centrifuge machines. Hazards coming from the production process come from the saponification process, bleaching process, fat washing, neutralizing, centrifuge, blending, rolling, cutting, packing. And hazards from production materials come from KOCl, marlon, HCl, H₂O₂, Upitek, Na₂SiO₃, NaOH, C₃H₈O.

Identification of hazard sources in the production division in the cotton and gauze industry is carried out by conducting an observation process in each work process in the cotton and gauze production division. The identification steps were carried out by inspecting and analyzing all work processes in the cotton and gauze production division and conducting interviews with the company manager and workers in the production division [11, 14]. From the results of the research, 4 main sources of hazards were obtained in the production section in the cotton and gauze industry, including: humans, production processes, production materials, and production processes: people, production processes, production materials, and production equipment. This is in accordance with that the source of hazard in the company can come from 5 sources, namely: people, production processes, production materials, production equipment [18, 19].

3.2 Potential Hazard

The identification of potential physical hazards in the production area of the cotton and gauze industry is carried out using the Job Safety Analysis method so this method is

carried out based on production activities. The results of the identification of potential hazards in the cotton and gauze production process found in the production area are as below:

Table 2. Results Of Potential Hazard Identification in The Cotton and Gauze Production Area

Type of Potential Hazard	Total Potential Hazards (n)
Physical	53
Chemical	12
Mechanic	3

Based on Table 2, physical hazards that we can find in companies include prolonged exposure to high-intensity noise, extreme temperatures (hot and cold), prolonged exposure to vibration, and radiation. Examples of other physical hazards that can be found in the work environment include exposure to UV light[20, 21]. The number of potential physical hazards found during the study was 53 potential hazards in the cotton and gauze production process. The production process that has the most potential physical hazards is the cotton and gauze saponification process with 13 potential hazards. The potential physical hazards that have been identified are in line with research conducted by[21, 22][19] that potential physical hazards that can be found in the work environment include noise from machinery and production equipment, hot ambient temperature, poor lighting, vibration caused by work tools, UV radiation[23].

Chemical hazards contain various potential hazards according to their nature and content to cause a hazard at work. Hazards that can be caused by chemicals include poisoning by chemicals that are toxic, irritation, by irritating chemicals such as harsh acids, battery water vinegar and others, fire and explosion, as well as pollution and environmental pollution due to chemicals. In this study, the number of potential chemical hazards found during the research was 12 potential hazards identified in the saponification process, bleaching process, fat washing process, screening process, and screening process. The potential chemical hazards that have been identified are in line with research conducted by [24, 25] in the book it is said that chemical hazards exist in the production process or repair of equipment that uses chemicals, so that it can cause chemical hazards. In addition, the study also found that one example of chemical hazards in the work environment is a gas leak so that chemicals can spread, so that in the research conducted by researchers found the same thing in the cotton and gauze production area[26]. The content of chemicals contained in production materials can be a danger to workers such as benzene and toluene which can be a potential chemical hazard when exposed to workers, so in this study there are also chemicals used as production materials in the manufacture of cotton and gauze[27, 28].

Types of hazards in the workplace can be mechanical hazards, such as potential hazards from moving objects or processes that can cause collisions, cuts, punctures, scratches, or falls.[2, 28, 29] In this study, the number of potential mechanical hazards found during the study was 3 potential hazards in the cotton and gauze production process. Potential chemical hazards were identified in the twisting process, rolling process, and cutting process. In the work environment, mechanical hazards can be found, especially in the process of operating machinery, examples of mechanical hazards that can

be found in the work environment are falling, slipping, slashing, pinching, being hit, being hit by cargo, equipment failure in the use of heavy equipment, which in our research found mechanical hazards in the form of slashing and pinching of production equipment [22, 29]

3.3 Risk Assasement

Risk assessment is a step after identification that aims to determine the level of risk by estimating the likelihood and impact of risks in the cotton and gauze industry production area [10, 13, 22, 29]. The results of the risk assessment on the production process in the cotton and gauze industry are as follows:

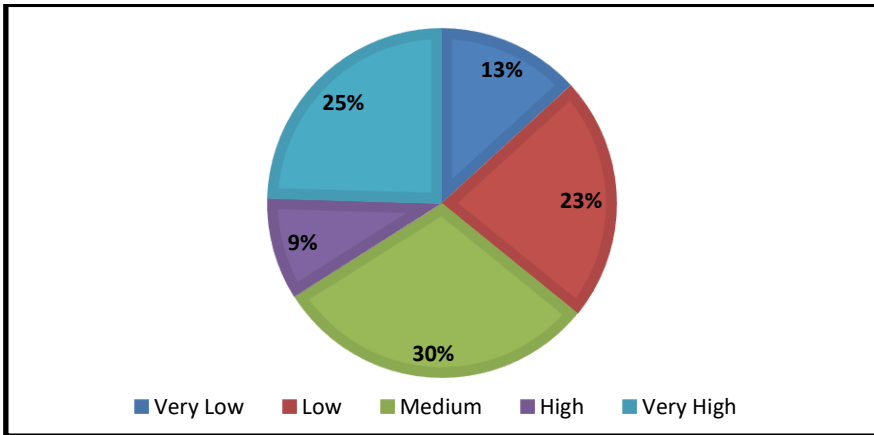


Fig. 1. Occupational Safety and Health Risk Level in the Cotton and Gauze Industry Production Area

Based on **Fig. 1**, The level of risk found in production activities in the cotton and gauze industry production area is very low, low, medium, high, and very high risk levels. From the results of the risk assessment, it was found that the highest level of occupational safety and health risk in the industrial production area was moderate risk at 30% (16 risks), the second was very high risk at 25% (13 risks), the third was low risk at 23% (12 risks), the fourth was very low risk at 13% (7 risks), and the last was high risk at 9% (5 risks). This assessment is based on a risk level assessment using AS/NZS 4360.

3.4 Risk Control

Every hazard risk found in the hazard identification process needs to be controlled to prevent it from becoming a hazard that threatens workers. Control is carried out by determining the priority scale first. Risk control uses a hierarchy of hazard control, namely: Elimination, substitution, engineering, administrative, and use of PPE [13, 22]In this study, each hazard risk found in the cotton and gauze production process at

the industry is controlled using the risk control hierarchy with 3 methods, namely the use of PPE, Administration, and Engineering Technology[19, 30]. The results of the risk control on the production process in the cotton and gauze industry are as follows:

Table 3. Results of Risk Controls in The Cotton And Gauze Production Area

RISK CONTROL	RESULTS
Engineering Technology	by making a tool to help facilitate the work of workers to avoid work accidents.
Administrative control	Continuing regular construction repairs, Creating and placing written SOPs on the equipment, Providing punishment if negligent in operating the equipment, and Making operational standards.
PPE Control	The forms of PPE use proposed by researchers are such as the use of masks, earplugs, safety glasses, cattlepacks, safety gloves, and safety boots.

Based on **Table 3.**, the Results of Risk Controls in The Cotton And Gauze Production Area for engineering technology is by making a tool to help facilitate the work of workers to avoid work accident, administrative control is continuing regular construction repairs, Creating and placing written SOPs on the equipment, Providing punishment if negligent in operating the equipment, and Making operational standards, and PPE Control is the forms of PPE use proposed by researchers are such as the use of masks, earplugs, safety glasses, cattlepacks, safety gloves, and safety boots.

Based on the results above, risk control that can be done at PT X is using PPE, administrative, and engineering technology methods. Risk control efforts using elimination and substitution methods are difficult to do because they will affect the production processes and materials used even though elimination and substitution are the best methods for risk control, so the methods that are often used are the use of PPE, administrative, and technological engineering because they are considered the easiest to do[2, 19, 30].

4 Conclusion

Based on the identification of potential hazards in the cotton and gauze industry production area using the Job Safety Analysis method, 4 sources of hazards were found in the production process in the cotton and gauze industry including humans, production equipment, production materials, and production processes. From these hazard sources, several potential hazards emerged, 53 potential physical hazards, 12 potential chemical hazards, and 3 potential mechanical hazards. From the potential hazards found, the risk assessment found that the risks classified as very low were 7 (13%) risks, low risk levels were 12 (23%) risks, moderate risk levels were 16 (30%) risks, high risk levels were 5 (9%) risks, and very high risk levels were 13 (25%) risks. From the results of identification and assessment, there are 3 methods used in risk control, including PPE use,

administrative, and engineering technology. 23 potential hazards are controlled with the use of PPE, 14 potential hazards with administrative, and 2 potential hazards with engineering technology.

Based on the results of the research on the Assessment of Potential Hazards with the Job Safety Analysis Method for Production Workers of the Cotton and Gauze Industry in 2023 to form a department that handles the Occupational Safety and Health Management System in accordance with Government Regulation No. 50 of 2012 concerning the Implementation of the Occupational Safety and Health Management System, improve supervision related to Occupational Safety and Health by conducting safety talks before carrying out work, and based on the risk control hierarchy, the most possible control to be carried out in controlling potential hazards that exist is by controlling technologically engineering, if this is not possible then administrative control can be carried out, and if it is not possible it can also be controlled by using Personal Protective Equipment (PPE). And research should be carried out on other potential hazards such as electrical and biological hazards to prevent work accidents, so from the hazards that have been studied there are potential hazards found, such as potential physical, chemical, and mechanical hazards so that employees are advised to be careful and care about the condition of the work environment.

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