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Assessment of Job Risks in the Chemical Laboratory of the Pharmacy Study Program with Job Safety Analysis (JSA) Techniques

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Abstract

Chemistry laboratory organizes practicum, one of them quantitative pharmaceutical chemistry which uses a variety of chemicals and tools where if not careful, not following instructions or procedures even underestimate will cause work accidents and/ or occupational illness. Including type of research is observational descriptive by identifying and analyzing of potency danger from each stage of the work which causes harm to the implementer or officer. Population is types practicum work in chemistry laboratory. The sample is, the quantitative pharmaceutical chemistry practicum. Data collection techniques i.e. choose the job to be analyzed, breaking the job into several stages of work, search and determines the findings of errors from each stage of the work, identify potential hazards associated with fault findings, identify possible happening consequences maybe, and then evaluate (control that can be done and suggestions for control) to existing found potency hazards. Researchers identify hazards, assess, and control K3 risks (Occupational Health and Safety) using observational data, namely a checklist based on activities in quantitative pharmaceutical chemistry practicum, namely work procedures and work steps to get fault findings and then researchers data analyze using the Worksheet JSA. The results showed that performs the titration step has high very risk level value compared to another work step other of pharmaceutical chemical practicum quantitative. Titration activities carry an extreme or significant risk of harm when performed incompatible with working measures and unsafe with potential danger (disadvantage) is liquid evaporates (inhaled), disturbances The End Point of the Titration: change in color and determination of concentration, and perform movements manual repetitive continuously namely mixing the liquid or rotating the container (erlenmeyer) contains a chemical liquid by hand continuously.

Keywords: Job Risk;Chemical Laboratory;Job Safety Analysis

INTRODUCTION

Point of view Occupational safety and health, injury or loss stems from unwanted events arising from the activities of the company or organization. Without implementing occupational safety and health risk management, companies are faced with uncertainty. K3 risk management is an effort to manage K3 risk to prevent work accidents for implementers (users) or officers because one of the most important or determine resources in the company or organization is human resources (Ummi, 2017).

Motivation in carrying out public safety and health work is to prevent the occurrence of work accidents so need to see the cause and effect. Identification of the danger to any kind of a job to do with the act of proper precautions and effective. The analysis of this danger for suggestion repair the SOP (Standard Operating Procedure) and to make known by all parties involved in the activity (Fitra, 2021).

Another motivation for implementing occupational safety and health is to prevent PAK (Occupational Diseases) and minimizing PAHK (Disease due to Work Relationship). The other results of practical activities in the chemical laboratory i.e. produce waste that needs to be identified as hazardous. Unprocessed the waste can have an impact on environmental pollution, so the action to overcome it for example with to neutralize the waste before it is disposed of, replacing materials chemical that are at high risk of with materials chemical relatively safe so that environmental pollution can be minimized (Muliyadi, 2020).

Occupational safety and health must be pursued for all fields of work and education, one of which is in the chemical laboratory. The chemical laboratory is a place for research and experiments that have the potential to cause an accident work. To minimize the risk due to work, it is necessary to apply K3 in the laboratory (Susiani I, 2017).

Initial observations made in the chemical laboratory of the pharmacy study program be discovered job that are not inappropriate among others pouring or dripping concentrated solution into the container at the acid cabinets desk sometimes without gloves or masks, pouring liquid in the container (e.g. chemical beaker) until it pass the limit line on the container and then heated on the hot plate so that the liquid spills into the heating plate, heats or burns the substance using a spritus lamp where the conditions of the valve (place the axis is attached) are not tightly with the mouth of the container so that spontaneously a relative large fire arises while burned.

Prevention of emergencies could be made to prepairingpreparedness including some planning and preparations to prevent an emergency situation. Preparedness is one of important aspects which must exist in hazards area, such as working in laboratory. Laboratory should implement Occupational Safety and Health (OSH). In academic laboratory, the students gets deeply explanation about emergency situations from spilled chemical materials, or electrical damage that happen at any times (Muafiroh *et al*., 2017).

In general, the effect of industrialization is the use of facilities and infrastructure such as machine, tools, installations, use hazardous materials which cause more risks and sources of potential hazards in the workplace and may increase the number of accidents work, occupational diseases, and environmental pollution. Hazards in a job must be managed properly so that the work can take place safely. One way to manage hazards at work is by conducting a risk assessment. To make it easier for workers to know the hazards and control their risks, one of the risk assessment methods are JSA (Pipit Marfiana *et al*., 2019).

In relation to the K3 program, this study identifies and analyzes the hazards of a work in a laboratory, especially a chemical laboratory that often occurs in work accidents with JSA. This method is a systematic and gradual study of all potential hazardous events that occur at each work step, to be able to determine various control measures necessary to prevent or reduce the impact of such hazardous events during the preparation and execution of the work (Nurkholis & Adriansyah, 2017)

Reference Government Regulation of the Republic of Indonesia number 50 of 2012 concerning the Implementation of OHS Management System regarding the explanation of article 9 paragraph 3 (letter b) which states “hazard identification, assessment and risk control are carried out on machines, aircraft, work tools, other equipment, materials, environment work, the nature of the work, *the way of working*, and the production process.

Method

Type of research is observational descriptive by identifying and analyzing of potency danger from each

stage of the work which causes harm to the implementer or officer.

The research was carried out in the chemistry laboratory the pharmaceutical study program in 2019. Research time for one month.

Population is types practicum work in chemistry laboratory. The sample is, the quantitative pharmaceutical chemistry practicum.

Data collection techniques i.e. choose the job to be analyzed, breaking the job into several stages of work, search and determines the findings of errors from each stage of the work, identify potential hazards associated with fault findings, identify possible happening consequences maybe, and then evaluate (control that can be done and suggestions for control) to existing found potency hazards.

Researchers identify hazards, assess, and control K3 risks (Occupational Health and Safety) using observational data, namely a checklist based on activities in quantitative pharmaceutical chemistry practicum, namely work procedures and work steps to get fault findings and then researchers data analyze using the Worksheet JSA.

RESULT AND DISCUSSION

Occupation quantitative pharmaceutical chemistry practicum in chemical laboratories pharmacy study program that using the following materials and equipment as follows:

Table 1. Quantitative Pharmaceutical Chemistry Practicum Occupation

Occupations	Materials	Equipment
Determination of acetosal tablet concentration by the asidi-alkalimetri method	Acetosal tablets (sample) Hydrochloric acid Phenolftalein (indicator) Orange methyl (indicator) Sodium hydroxide Sodium carbonate anhydrous	Burette 50 ml Erlenmeyer 250 ml Chemical beaker 100 mL Measuring cup Volumetric flask 500 mL Analytic balance sheet Volume pipette 25 mL Drop pipette

Table 1 shows that the composition of materials and equipment that is used in practicum but there are unwritten specifications or less complete among which the selection of materials that include Pro-Analysis (PA) or technical, concentration of ingredients, and volume or tool specifications. It found there were ingredient and tools that were not written on the practicum module but were used in the working procedure.

Incomplete or could unwritten specifications for materials and tools cause the user to incorrectly select and use them because users tend to prepare or use equipment and materials as written on worksheets (modules) that ultimately affect the process and results of practicum as well as the potentially for occur work accidents (Fitra, 2021).

According to Fitra (2021) every activity involving humans, the effectiveness of its implementation depends largely on each individual's perspective on what he or she should do and also the basic factors that cause accidents and/ or illnesses, namely human factors (e.g. less of knowledge and skills) and occupational factors (e.g. improper work planning standards and abnormal use) that can ultimately lead to stress and error.

Table 2. Quantitative Pharmaceutical Chemistry Practicum Step Work

Occupations: Determination of acetosal tablet concentration by the asidi-alkalimetri method		
Working Procedure	Working Step	Fault Findings
Standardization of 0.1 N HCl titer solution	Titration with hydrochloric acid (HCl) solution until the color of the solution changes from yellow to orange	There are no further explanations or notes on how to carry out titration activities according to recommended work steps (stages) or according to procedures and safe
		There is no further record of the use of appropriate and concise containers for pouring liquids through the part mouth of the burette
		The tool used for practicum was not written, namely aluminum foil to cover the part mouth of the burette and the mouth of the part container (erlenmeyer)

Table 2 shows that before filling out JSA worksheet it is advisable to determine or write down error findings. According to the consideration of researchers by adding or determining the findings of errors that are not listed on the JSA worksheet, then the addition column fault findings will help the determine list potential hazard or injury or loss in JSA worksheet..

Table 3. Worksheet JSA

Occupations: Determination of acetosal tablet concentration by the asidi-alkalimetri method								
Working Procedure: Standardization of 0.1 N HCl titer solution								
Working Step: Titration with HCl solution until the color of the solution changes from yellow to orange								
Fault Findings	Potential of Injury / Danger / Loss	Consequences	Risk Matrix			The Necessary Control	Suggestion	Responsibility
			S	L	RR			
There are no further explanations or notes on how to carry out titration activities according to recommended work steps (stages) or according to procedures and safe	Liquid evaporates (inhaled), Disturbances The End Point of the Titration (TAT): affect change in color and determination of concentration, and The perform movements manual repetitive continuously namely mixing the liquid or rotating the container (erlenmeyer) contains a chemical liquid by hand continuously	Cause severity to disease (e.g. asthma), Miscalculation, and May cause Tendinitis	3	5	15 (E)	Close the buret mouth and spooler mouth receptacle, rinse buret, titration of slowly and constant, as well as put a little of vaseline on the buret lock section	Use aluminum paper for the lid, use distilled water for rinsing	User and supervisors of practicum

There is no further record of the use of appropriate and concise containers for pouring liquids through the part mouth of the burette	Liquid can spill and uses a lot of tools	The inconvenience	1	2	2 (L)	Choose a container for pouring a suitable solution that has small indentations	Pour the solution into the mouth of the burette slowly
The tool used for practicum was not written, namely aluminum foil to cover the part mouth of the burette and the mouth of the part container (erlenmeyer)	Liquid evaporates and is inhaled	Headaches (dizziness)	2	2	4 (L)	Write the completeness of the name of the tool used for the practicum	Completeness is checked by matching tool names with work steps

S = Severity, L = Likelihood, RR = Risk Rating, E = *Extreem / significant*, L = *Low* / *rendah*

Table 3 shows that performs the titration work step be discovered high very risk level value (extreme) i.e. fault findings: "There are no further explanations or notes on how to carry out titration activities according to recommended work steps (stages) or according to procedures and safe" with consequence cause severity to disease (e.g. asthma), miscalculation, and may cause tendinitis. That at working step do titration is relatively to be careful, if done wrongly or mistaken or take it lightly it can cause harm consequences for the user and also affect determination of the final result.

The titration activity which has the highest level of risk (extreme), then the follow-up is carried out, namely the titration cannot be carried out or continue until the risk can be reduced by the availability of existing resources (Marfiana, *et al*., 2019).

Potential injury or loss are directly related to human behavior factors and potential mistakes made by humans can arise at any time. Another mistake about lack of knowledge be in the form of way titration and procedure can lead to errors during titration and potentially other lead to injuries such as dermatitis. Research by (Antara *et al.*, 2016) shows that knowledge about occupational safety and health has an impact on the incidence of work accidents, one of them is contact dermatitis (Ferusgel *et al*., 2020). Another consequence of titration activities carried out manually and repeatedly in a standing position has the potential to cause back, shoulder and neck disorders due to the bending work process (Siboro & Surifto, 2017).

In other research about work accident that most often experienced by executor (user) in the laboratory is in contact with hot, followed by exposed to a chemical spill, and complain of

dizziness due to inhaling chemicals during work so proper control hazard is needed i.g. protective personal equipment (Cahyaningrum, *et al.*, 2019).

Laboratory supervisors need to be trained and given good knowledge about work safety so that they can accompany the practitioner during the activity in order to reduce or avoid work accidents in the laboratory (Hermida, et al., 2018).

Risk appraisal are used to properly manage the risks workers face and ensure they are not exposed to risks while working. Identification of hazards is basically accident prevention. Hazard identification is an activity that differs between one person and another (subjective) depending on experience and behavior in the face of risk (Ummi, 2017). Knowledge of work safety also affects compliance at work (Ni, *et al.*, 2020).

Research conducted by (Abidin, *et al.*, 2019) states that JSA is one of the tools that important to help eliminate hazards and reduce work injuries and accidents at workplace. Data from this research students who will do practicum in laboratories are required to fill out a form JSA that has been provided by the laboratory manager, but there are still many students who do not discipline in its implementation. fill JSA only to carry out administrative only, no earnestly as an effort prevention of work accidents, so that still experiencing cases work accidents such as splashing chemicals or spillage of materials.

Research by (Bawang, *et al*., 2019), shows that every job has its JSA so that the danger can be minimized. Work accidents can be avoided by knowing and recognizing the various potential hazards that exist in the work environment. With JSA, workers can work safely and efficiently, know the hazards that exist in their work and their control measures, and can increase knowledge and awareness of the importance of occupational health and safety.

Several methods use in identifying hazards, one of which is JSA. A hazard analysis technique that identifies in detail the steps of each stage of the work. The stages in conducting a JSA include choose the job to be analyzed, breaking the job into several stages of work, identify hazards associated with each stage of work, identify possible consequences, then evaluate existing hazards (Fitra, 2021). JSA can also be used to identify hazard several job high risk areas and can be fatal from something work processes (Thepaksorn *et al*., 2017).

Research by (Martino, *et al*., 2015) states the hazard identification stage can be known from various sources, including accidents that have occurred. Several stages in the implementation of Job Safety Analysis can be seen as follows: select the job to which the potential hazards will be identified, divide the work into several, activities identify the potential hazards of some of these activities and define controls for potential hazards.

To control the risk of work accidents can be done by to something engineering by changing the layout of the facility or work process. Risk control with to the management engineering can also be done by changing the schedule and making Standard Operating Procedures (Sulistiyowati *et al*., 2019)

After getting the job with the highest risk, further identification is carried out using the Job Safety Analysis method which discusses in detail the stages of work. The method JSA describes the details in the work such as tools and materials used, work methods, and work environment (Jannah *et al*., 2014)

The JSA method is a method for knowing or identifying risks and hazards to occupational safety and health which are divided into each stage of work according to the work being carried out so that

through this method, the risks in the field of K3 will be known with detail and thoroughly. Identifying potential hazards is an attempt to find out the existence of hazards at each stage of work when carrying out activities or activities using the JSA Method (Kawatu *et al*., 2018). The study demonstrates that too many JSA is are performed for activities in which barriers and procedures should have been established prior to initiating the JSA. Although hazard control can be established on the basis of other methods than JSA, the method has other benefits in terms of safety as well as production (Albrechtsen *et al*., 2019)

According to (Pipit Marfiana *et al*., 2019) stated that the dangers in a job must be managed properly so that the work can take place safely. One way to manage hazards at work is to carry out a risk assessment. One way or method of risk assessment is JSA. The risk assessment process using the JSA method consists of determining the work activities to be carried out, identifying hazards and determining the impact of hazards and then determining appropriate controls so that the risk of work accidents can be minimized.

According to (Putri and Ulkhaq, 2017) stated that accidents are in the form of being hit, scratched, and pinched by tools / workpieces, electrocuted by high voltage electricity, slipping during work activities, fainting, being hit by welding splinters and falling into waterways where avoid this happening again, it is necessary to identify the potential for work accidents, one of which is the JSA method. The advantage of implementing the JSA is that it provides recommendations for the best work methods so that the safety, health and safety of workers are guaranteed.

CONCLUSION

The risk of working in a chemical laboratory for quantitative pharmaceutical chemistry practicum activities is generally acceptable but with supervision or monitoring. The stage of doing the titration, it becomes extra attention from the user or practicum supervisor because it has the highest level of risk. This study shows that too many JSA is are done for activities where the obstacle and procedures should be established before starting the JSA.

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