

MANAGEMENT OF EXPIRED LIQUID CHEMICALS IN GUNUNG BATU'S CHEMISTRY LABORATORY OF HEALTH POLYTECHNIC OF THE MINISTRY OF HEALTH BANDUNG IN 2018

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Abstract

Introduction: Hazardous waste materials can be generated from laboratory use sourced from expired chemicals. The purpose of this study examines how the management of expired chemicals in Gunung Batu's chemistry laboratory of Health Polytechnic of the Ministry of Health Bandung. **Method:** This study used descriptive case study observational design. The study population was all chemistry laboratory managers and all expired liquid chemicals of Health Polytechnic of the Ministry of Health Bandung in 2018 with a total sampling method. The variables studied were volume, the amount based on its characteristics, reduction stage, packaging stage, storage stage, collection stage, utilization stage, processing stage, and accumulation of liquid chemicals. The laboratories studied were the environmental health, nutrition, and health analyst laboratory. The result of interviews and observations collected data collection, and then it was used to analyze. **Result and Discussion:** The results of the expired liquid chemical volume measurement at Gunung Batu's chemistry laboratory Health Polytechnic of the Ministry of Health Bandung in 2018, were 108,138 milliliters. The expired liquid chemical measurement results based on their characteristics obtained results as many as 4.2% explosive, 50% flammable, 33.3% corrosive, and 12.5% toxic. According to observations and interviews, the chemistry laboratory has not implemented seven stages of chemical management correctly. **Conclusion:** The management of expired liquid chemicals in Gunung Batu's chemistry laboratory at Health Polytechnic of the Ministry of Health Bandung in 2018, does not fulfill the requirements.

INTRODUCTION

A laboratory is a place used to conduct experimental processes, chemical analysis, measurement, research, or scientific research related to science and other sciences. The process result leads to the formation of a byproduct and contaminated chemicals. Laboratory waste contains many organic and inorganic compounds (1-2). Laboratory liquid waste is obtained from the remains of chemicals that are finished in practice, and the result of washing used tools (1,3). Laboratory liquid waste is a hazardous and hazardous waste material (B3) as a water polluter because its components consist of solid materials (tissues, reacting deposits, agar media), organic and inorganic waste that can cause health disorders such as heavy metals (4-6). Expired chemicals are also B3 waste that can threaten human health (3,7). Thus, it is necessary to have exceptional management that is safe to cope with B3 waste derived from chemistry laboratories; it follows the quality standards to be disposed of in the environment (8).

Government Regulation of Republic Indonesia No.101 year 2014 about The Management of Hazardous and Toxic Materials Waste (B3) stated that everyone who produces B3 waste must manage it (9). Besides ensuring that the waste manager is competent and compliant with the regulations, B3 waste producers must also be responsible for the beginning of waste produced until the waste is destroyed. It takes special handling to manage B3 waste in chemistry laboratories. Research conducted in Hasanuddin University year 2017 obtained that all faculty members implemented a B3 waste management system using applicable regulations (10).

Health Polytechnic of the Ministry of Health Bandung is an institution that advances learning and research activities to apply the science of recognition and technology. Research is one of the efforts to advance science and technology. Every semester, the use of this laboratory is used continuously and always using chemicals. The use of this laboratory will undoubtedly produce various types of waste, including Hazardous and Toxic Substances (B3) waste sourced from expired chemicals.

Based on the researchers' observations, the process of managing the expired chemicals waste in Health Polytechnic of the Ministry of Health Bandung, is still not following Government Regulation of Republic Indonesia No.101 year 2014 about The Management of Hazardous and Toxic Materials Waste. The laboratory is owned by the Health Polytechnic of the Ministry of Health Bandung, which is located in the area around densely populated dwellings. Thus, it results from waste

management not being appropriately controlled, which will harm the residents' environment and health around the laboratory site. There are still minimal studies that identify and describe the management of chemicals in the laboratory of Health Polytechnic of the Ministry of Health Bandung. Hence, the researchers are motivated to research "Management of Expired Liquid Chemicals in Gunung Batu's chemistry laboratory of Health Polytechnic of the Ministry of Health Bandung in 2018".

METHOD

This research used a descriptive case study observational design. The research population was the entire management of chemistry laboratories and all expired liquid chemicals in Gunung Batu's chemistry laboratory of Health Polytechnic of the Ministry of Health Bandung in 2018. Sampling techniques used the total sampling method. Human samples were as many as three people, and environmental samples consisted of all expired liquid chemicals found in chemistry laboratories in environmental health, nutrition majors, and health analysts. This research was conducted from March to May 2018. The variables studied were volume, amount based on its characteristics, reduction stage, packaging stage, storage stage, collection stage, utilization stage, processing stage, and expired liquid chemical hoarding stage.

The primary data obtained from the results of the data collected with interview method, volume measurements, observations on the amount of expired liquid chemicals based on their characteristics, and management observations that had been made consist of reduction, packing, storage, collection, utilization, process, and store laboratory that produced by Gunung Batu's chemistry laboratory of Health Polytechnic of the Ministry of Health Bandung. Secondary data in this study was obtained indirectly by the data studied at Health Polytechnic of the Ministry of Health Bandung, Gunung Batu Campus, regarding the campus's general picture (11). Data collection instruments used include observation sheets to identify the amount of expired liquid chemicals based on their characteristics and the management of expired liquid chemicals produced by laboratories, measuring glasses, and volumetric pipettes to measure the expired liquid volume chemicals produced by laboratories and cameras used as complements to documentation.

The data analysis was used a univariant analysis studied that describes the characteristics of the variables studied. Data analysis from measurements of expired chemicals obtained was analyzed and expressed in milliliter units. Analysis of observational data on the

number of liquid chemicals expired based on their characteristics analyzed and expressed in percentage form. Analysis of observational data on chemical management was analyzed and specified the weight of assessment on each item.

RESULT

Expired Chemicals

This research was conducted at the chemical storage site in the chemistry laboratory, where observations were made to expired chemicals. The results of research conducted in the chemistry laboratory of the department of environmental health found 11 types of expired liquid chemicals, in the chemistry laboratory majoring in nutrition, found nine types of liquid chemicals expired, and in the chemistry laboratory majoring in health analysts found ten types of liquid chemicals expired. Besides that, the study results found that expired chemicals were not separated and stored in the same room.

Frequency Distribution of Expired Liquid Chemicals Volume at Health Polytechnic of the Ministry of Health Bandung, Gunung Batu in 2018.

Based on Table 1, the total measurement of the volume of expired chemicals produced by Health Polytechnic of the Ministry of Health Bandung, Gunung Batu Campus in 2018 was 108,138 ml with the following divisions: environmental health department of 46,414 ml, nutrition department of 19,935 ml, and health analyst department of 41,789 ml.

Table 1. The Frequency Distribution of the Number of Liquid Chemicals Expired According to Its Characteristics in the Chemical Laboratory of Health Polytechnic of the Ministry of Health Bandung Gunung Batu 2018

The Location of the Laboratory Chemical	The Volume of Liquid Chemical Expiration (ml)
Environmental Health	46,414
Nutrition	19,935
Health Analyst	41,789
Total	108,138

Frequency Distribution of Expired Liquid Chemicals Number based on Their Characteristics in Health of the Ministry of Health Bandung, Gunung Batu in 2018.

Based on Table 2, the observation of the expired liquid chemicals number produced was obtained characteristics of expired liquid chemicals based on their characteristics. The expired liquid chemical produced by the environmental health department was 8.3% explosive, 50% flammable, 33.4% corrosive, and 8.3%

toxic. The number of liquid chemicals expired based on their nutrition laboratory characteristics was 7.7% explosive, 53.8% flammable, 30.8% corrosive, and 7.7% toxic. Thus, in laboratory health analysts were 50% flammable, 33.4% corrosive, and 16.6% toxic.

Table 2. The Frequency Distribution of the Number of Liquid Chemicals Expired According to Its Characteristics in the Chemical Laboratory of Health Polytechnic of the Ministry of Health Bandung Gunung Batu 2018

Characteristics	Environmental Health		Nutrition		Health Analyst	
	f	%	f	%	f	%
Easy To Explode	1	8.3	1	7.7	0	0
Easy Lit	6	50	7	53.8	6	50
Reactive	0	0	0	0	0	0
Infectious	0	0	0	0	0	0
Corrosive	4	33.4	4	30.8	4	33.4
Toxic	1	8.3	1	7.7	2	16.6
Total	12	100	13	100	12	100

Frequency Distribution of Liquid Chemicals Management at the Chemistry Laboratory Health Polytechnic of the Ministry of Health Bandung, Gunung Batu in 2018

Based on Table 3, the management of liquid chemicals in the chemistry laboratory on Health Polytechnic of the Ministry of Health Bandung located in Gunung Batu Campus majoring in environmental health, nutrition, and health analysis has not been qualified (100%) from the reduction stage, packaging stage, storage stage, collection stage, utilization stage, processing stage to liquid chemical hoarding stage.

Table 3. Distribution Frequency the Management of the Chemical Liquid in the Chemical Laboratory of Health Polytechnic of the Ministry of Health Bandung Gunung Batu 2018

Variable	f	%
Stage of Reduction		
Eligible	0	0
Not eligible	3	100
Total	3	100
Stage of Packaging		
Eligible	0	0
Not eligible	8	100
Total	8	100
Stage of Storage		
Eligible	0	0
Not eligible	17	100
Total	17	100
Stage of Collection		
Eligible	0	0
Not eligible	12	100
Total	12	100

Variable	f	%
Stage of Utilization		
Eligible	0	0
Not eligible	3	100
Total	3	100
Stages of Processing		
Eligible	0	0
Not eligible	1	100
Total	1	100
Stage of Hoarding		
Eligible	0	0
Not eligible	1	100
Total	1	100

DISCUSSION

The determination of the adjustment of the quantity of procurement of chemicals following the requirements, namely by performing the chemical adjustment, is what will be used and how the amount needed in each lab and customize with the number of students and the frequency of use performed repeatedly. It can be determined that the number of chemicals following the needs without any excess or deficiency (12). Based on Table 3, the reduction of the chemical liquid in the chemistry laboratory to the three majors is not yet eligible because it is not carried out to reduce the chemical liquid in practical activities both in material substitution, process modification, or the technology used. The purpose of reducing the liquid chemical is to minimize contamination caused by the harmful ingredients in the chemicals themselves with a path reduction at the source and the utilization of the waste itself (13-14). Therefore, the waste generated from the process of practical activities does not decrease the quality of the environment.

The producer of B3 waste must know the characteristics of any waste that is collected/ generated for it need to know the type of packaging used for storing waste (15). Based on table 3, the stages of the chemical liquid packaging in the chemistry laboratory Health Polytechnic of Ministry of Health Bandung, department of environmental health, nutrition, and health analysts are still not eligible because it is not done packaging the expired chemical liquid. According to Government Regulation of Republic Indonesia No.101 year 2014 about The Management of Hazardous and Toxic Materials Waste, B3 waste management is required to perform the packaging of B3 waste according to their characteristics. The packaging of B3 waste should be done with packaging made of a material that can pack the B3 waste according to the characteristics of B3

waste stored, able to trammel the B3 waste to remain in the packaging, has a firm cover to prevent spills when the storage, removal or transport and in good condition, not leaking, not corroded and not damaged.

Storage of materials chemistry aims to avoid mixing harmful chemicals that can cause a reaction when close to each other. Based on Table 3, the liquid chemical storage in the chemistry laboratory Health Polytechnic of the Ministry of Health Bandung, department of environmental health, nutrition, and health analysts are still not eligible because it does not contain storage building packaging expired liquid chemicals in particular. The place of storage of expired chemical liquid still put together with chemicals that have not yet expired. According to the Government Regulation of Republic Indonesia No.101 year 2014 about The Management of Hazardous and Toxic Materials Waste, storage of B3 waste must fulfill the requirements of the location of B3 waste, the amount of B3 waste must have appropriate waste storage facility B3, the characteristics of the B3 waste and comes with efforts to control environmental pollution as well as equipment for combating emergencies.

The collection is the transportation stage of B3 waste from containers and collection facilities towards the temporary shelters (16). Based on Table 3, the collection of liquid chemicals in the chemistry laboratory Health Polytechnic of the Ministry of Health Bandung, department of environmental health, nutrition, and health analysts are still not eligible; not there are buildings where the collection of liquid chemicals expired. Utilization of waste re-use, recycling to modify the B3 waste into a useful product and can be re-used and are not harmful to humans and the environment. Based on Table 3 that the use of liquid chemicals in chemical laboratories of the three departments are still not eligible because there is no description of the processor utilization of the liquid chemical out of date and the equipment used for the management of liquid chemicals expired in the Health Polytechnic of the Ministry of Health Bandung or cooperation with third parties.

A process to eliminate or reduce the hazards or toxic properties, namely the management (17). Based on Table 3 that the processing expired chemical liquid in the chemistry laboratory Health Polytechnic of the Ministry of Health Bandung, department of environmental health, nutrition, and health analysts are still not eligible because it is not done processing expired chemical liquid through thermal /or stabilization/ or solidification/ or according to development of science and technology in the Health Polytechnic of the Ministry of Health Bandung or cooperation with third parties.

The accumulation of the expired chemical liquid in the chemistry laboratory Health Polytechnic of the Ministry of Health Bandung, department of environmental health, nutrition, and health analysts are still not eligible because it is not contained Health Polytechnic of the Ministry of Health Bandung or cooperation with third parties according to Table 3.

The chemistry laboratory manager has not conducted the seven stages of the management of expired chemical liquid. Most of the expired chemical liquid in the packaging has been separated and collected in the corner of the storage place of chemicals without any follow-up effort. The chemical liquid expires, partly kept in the same rack with the chemical liquid that has not yet expired, and expired chemical liquid is still used for practical activities. To manage B3 waste in the laboratory is necessary to do surveillance labeling, temporary shelter B3 waste, and being separated from chemicals that are still in use (14).

Expired liquid chemical storage at the Environment laboratory's health is usually stored in a shed near the workshop, but for security reasons, then a chemical liquid expired is not stored in the back of the warehouse. While in the chemistry laboratory of the department of nutrition and health analyst, the seven stages of management of expired chemicals liquid have not been conducted by the chemistry laboratory manager. The entire expired chemical liquid is still stored in its packaging and placed in the same rack with the chemical liquid, which has not yet expired and is still used in practical activities to the expired chemical liquid until it runs out.

Packaging materials of expired chemical liquid have to be accommodated in different containers following the characteristics of the expired chemical liquid produced in the chemistry laboratory. To facilitate the packaging of expired liquid chemicals, any laboratory manager has to make the identification of the expired chemical liquid and group them according to their characteristics.

Before further processing, the expired chemical liquid packaged should be stored in a temporary storage place. Besides, it is obliged to apply for permission to the Ministry of Environment for the producer that has the storage place. Health Polytechnic of the Ministry of Health Bandung, Gunung Batu Campus currently has a temporary storage place for expired chemicals liquid. Therefore the researcher recommends that the constructed storage areas for chemicals generated by the chemistry laboratory of the department of environmental health, nutrition, and health analyst considering the layout of the storage of B3 waste based on its characteristics.

Building expired liquid chemical storage should be built in a location that is not prone to disaster, and within 50 meters from public areas and should be designed to accommodate expired liquid chemicals of any chemistry laboratory there in Health Polytechnic of the Ministry of Health Bandung, Gunung Batu Campus so that the expired chemical liquid can be managed with good and effects of an expired chemical liquid can be minimized. The entire expired chemical liquid that has been packed and stored in a container while should be given the bulkhead of each of its characteristics and not brought near each other. Expired chemicals liquid that has been packed and stored in the temporary storage areas to be transported to the place of processing/ utilization/hoarding maximum for each semester once, it is adjusted by Regulation of the Government Regulation of Republic Indonesia No.101 year 2014 about The Management of Hazardous and Toxic Materials Waste article 28 paragraph 1 item b of long time storage to a producer that produces B3 waste as much as <50 kg per day for category 1 (a) is 180 days after such waste is produced. The collection, utilization, processing, and stockpiling of expired chemical liquid are efforts to minimize the hazard posed by the expired chemical liquid produced. At the stage of collecting, utilization, processing, and stockpiling of expired chemical liquid can be performed independently and by a 3rd party has permission to perform management of an expired chemical liquid.

CONCLUSION

The volume of the expired chemical liquid-generated chemistry laboratory Health Polytechnic of the Ministry of Health Bandung, Gunung Batu Campus in 2018 is 108,138 mL. Measurement of the amount of liquid chemical is expired based on its characteristics 4.2% classified as explosive, 50% is easy to light up, 33.3% of the corrosive, and 12.5% non-toxic. The management of the chemical liquid from the stage of reduction, packaging, storage, collection, utilization, processing, and stockpiling is not yet eligible.

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