

THE IDENTIFICATION OF OCCURRENCE AND COMPOSITION OF HAZARDOUS MEDICAL WASTE AT DEPOK CITY PUBLIC HEALTH CENTER

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Abstract

Purpose of the study: Hazardous solid medical waste, contains infectious, pathologic, sharp objects, pharmaceuticals, cytotoxic, chemical, radioactive, pressurized containers, and has a high heavy metal content and endangering the community. The Minister of Environment and Forestry of the Republic of Indonesia No.56 of 2015 regulates hazardous waste, but the study of the implementation and compliance with the regulation are still limited.

Methodology: Qualitative descriptive method is carried out to describe and explain the condition of variables contained in the object of research.

Main Findings: In general, the health center in Depok has carried out sorting consisting of sharp medical waste and non-sharp and reduced hazardous waste. The composition of non-sharp hazardous medical waste ranges from 55% to 96%.

Applications of this study: Primary data collection was carried out in 11 Health Center in 11 sub-districts of Depok City.

Novelty/Originality of this study: The number of sub-district residents does not always determine the average number of patients coming from the health center which ranges from 100-300 patients. With the average number of patients coming in at 300 people/day, Cipayung health center produced 1,821 grams/day, in contrast to Pancoran Mas and Sukmajaya which produced 2,398 and 3,357.

Keywords: *Infectious Waste, Medical Waste, Waste Management, Public Health Center, Depok City.*

INTRODUCTION

Along with the development of service activities from the health sector in Indonesia, the government's attention to the potential for hazardous medical waste generation is increasingly massive ([Ananth, Prashanthini, & Visvanathan, 2010](#); [Chaerul, Tanaka, & Shekdar, 2008](#); [Irianti, 2013](#)). This is important because hazardous medical waste can be very potentially harmful to public health and the environment. In many countries, hazardous and medical wastes are still handled and disposed together with domestic wastes ([Bdour, Altrabsheh, Hadadin, & Al-Shareif, 2007](#); [Da Silva, Hoppe, Ravello, & Mello, 2005](#); [Sawalem, Selic, & Herbell, 2009](#); [Taghipour & Mosafari, 2009](#)), thus creating a great health risk to municipal workers, the public and the environment ([Studdert et al., 2005](#)). Simultaneously the level of education and income has a positive impact on the public perception of the comparison of environmental health ([Sari, Madonna, & Fitriani, 2018](#)). According to the Decree of the Minister of Health No. 1204 of 2004 ([Menteri Kesehatan, 2004](#)), the notion of hazardous solid medical waste is an infectious type of waste, pathologic, sharp objects, pharmaceuticals, cytotoxic, chemical, radioactive, pressurized containers, and has a high heavy metal content. Managing medical waste is based on hierarchical structures from generation to disposal. Priority approaches are given to reduce the number and potential hazards. If this is not possible, management includes a reduction by sorting and separating, pre-treatment on site, safe transportation, final maintenance and disposal of sanitary ware ([Marinković, Vitale, Holcer, Džakula, & Pavić, 2008](#)).

Depok Municipality consists of 11 sub-districts, where each sub-district has several types of health facilities (Puskesmas). One of them is puskesmas with the status of a Technical Implementing Unit (UPT) at the level of the Regional Unit Service Agency (BLUD) which oversees puskesmas with the Functional Implementation Unit (UPF) status. At present, the City of Depok has a total of 35 puskesmas units, consisting of 11 UPT Puskesmas and 24 UPF Puskesmas under it. Better education of healthcare workers and standardized sorting of medical waste streams are efficient waste management at healthcare facilities ([Atkin & Brooks, 2015](#); [Windfeld & Brooks, 2015](#)).

There are regulations at the national level, namely the Law of the Republic of Indonesia No. 32 of 2009 concerning "Protection and Management of the Environment", that every person who produces hazardous waste must carry out the management of hazardous waste produced. If everyone is unable to carry out their own hazardous waste management, the management is left to another party ([Nugroho, 2013](#)). The law is a reference to the Republic of Indonesia Minister of Environment and Forestry Regulation No.56 of 2015 concerning "Procedures and Technical Requirements for the Management of Hazardous and Toxic Waste Materials from Health Service Facilities" ([Nayla, 2019](#)). The Minister of Environment Regulation is the basis for the Depok City Government to issue a Regional Regulation No. 3 of 2013

concerning "Guidelines for Environmental Protection and Management" (Tompodung, 2017). Waste management is a systematic, thorough, and continuous activity that includes waste reduction and handling (Sari et al., 2018). The development of effective medical waste management is crucial for the prevention of the potential exposure of healthcare service workers, patients, and the public to infections, toxic chemicals, and accidental hazards as well as the protection of the environment (Jang, 2011).

Although there are already regulatory tools, how to implement and comply with these regulations requires an in-depth study given the limited facilities, human resources, and funds they have. Most of the healthcare centers of the developing world have faced financial difficulties and therefore looking for cost-effective disposal methods of clinical waste (Omar Abdulkadir & Calmfors, 2019). Therefore, this study aims to identify the amount of generation and composition of hazardous medical solid waste in UPT Puskesmas in 11 sub-districts in Depok City, and reviewing the implementation of hazardous medical waste management in all its management stages (from cradle to grave) which have been carried out in Puskesmas linked to the limited resources available. Measuring and quantifying the amount of medical waste generated in each unit of the medical institutions periodically to find out the amount of waste generated is essential. In so doing, an indication of the resource that needs to be allocated may be known (Bokhoree, Beeharry, Makoondall-Chadee, Doobah, & Soomary, 2014). All of this can be taken into consideration and can be used as recommendations in making decisions that will be made by the Depok City Government.

METHODS

To support the final results of this study, it is necessary to collect process and analyze primary data in the form of sampling and questionnaire dissemination as well as secondary supporting data collection. Data collection was carried out in 11 UPT Puskesmas in 11 sub-districts in Depok City, namely Pancoran Mas District, Beji District, Sukmajaya District, Cimanggis District, Tapos District, Cilodong District, Limo District, Cinere District, Sawangan District, Cipayung District, and Bojongsari District. The sampling of medical hazardous solid medical waste refers to the sampling procedure carried out based on SNI 19-3964-1994 concerning the Method of Taking and Measuring Examples of Embossment and Composition of Urban Waste. The sampling was conducted to obtain the generation data and composition of hazardous medical solid waste produced (Atkin & Brooks, 2015; Windfeld & Brooks, 2015). The frequency of sampling was carried out during working days, i.e. 8 consecutive days. Secondary data can be obtained from government agencies or other related parties.

Methods with the use of processed statistics were also carried out to process all information on the implementation of hazardous medical waste management activities in 35 Depok City health centers. The method includes descriptive methods, both qualitative and quantitative. Qualitative descriptive method is carried out to describe and explain the condition of variables contained in the object of research. A quantitative descriptive method is used to determine the relationship between variables in the study using statistical calculations and mathematical numbers. Qualitative descriptive is done by observing the mean value of the respondent's answers and explaining them in sentences. According to the research descriptive research has characteristics that tend to describe a phenomenon as it is by examining it regularly, prioritizing objectivity, and being done carefully (Arif, 2007).

In this case, the activities carried out were data collection conducted through questionnaires regarding the reduction and sorting of hazardous waste, storage of waste, and transportation of hazardous medical waste. The questionnaire is divided into 2 parts, namely an open questionnaire that aims to gather information related to the activities of the puskesmas that produce solid hazardous medical waste and a closed questionnaire to get conclusions from statistical processing on the implementation of Minister of Environment Regulation P.56 / Menlhk-Setjen / 2015 (UURI, 2004). The questioning consisted of 11 questions about waste reduction and sorting, 8 waste storage questions, and 10 questions related to waste transportation.

RESULTS AND DISCUSSION

Public health centers in Depok currently have a health service room that is different from one another even though they have the same status as UPT. Of the 11 puskesmas which were the sampling points, 36% of puskesmas had public polyclinics, 90% of puskesmas had dental polyclinics, 90% of the puskesmas had 9 laboratories, 100% had health and maternal health facilities, 27% had pulmonary TB rooms, 18% had Essential Basic Neonatal Obstetrics Services (PONED), 18% had a delivery room 2 and 36% had an ER.

Occurrence and Composition of Hazardous Medical Solid Waste

The Questionnaire data were obtained from 35 research respondents, namely Puskesmas in Depok. The Processed results of the questionnaire revealed that hazardous solid medical waste of puskesmas was placed in safety boxes for sharp medical waste and non-sharp medical waste was placed in yellow trash bags or yellow plastic. Table 1 below is the data on the average number of patients and the number of hazardous Medical Waste generation in Depok City Health Centers per day.

From Table 1, it is known that the population of the sub-district does not always determine the average number of patients coming from the UPT Puskesmas. Several factors allegedly affect this, such as types and hours of service, differences in population density that are potentially infectious diseases, environmental pollution, high economic levels

of patients tend to choose clinics or hospitals, distance, and location. UPT Puskesmas Mas Sukmajaya, Cipayung has a strategic location, namely at the crossroads and the ease of transportation modes. Another factor is that there are several UPF Puskesmas that are also ready to serve and the existence of immunization and prospective hajj services.

Table 1: The Average Occurrence of Waste Percentage Hazardous medical at Depok City Health Center

Puskesmas	Number of Patients per Day (people)	Total Weight (gram / day)	Population*
UPT Pancoran Mas	± 300	2.398	273.447
UPT Beji	± 200	1.890	215.215
UPT Cimanggis	± 240	1.390	313.987
UPT Sukmajaya	± 300	3.357	302 719
UPT Cinere	± 100	594	139.606
UPT Limo	± 150	1.311	113.684
UPT Bojongsari	± 150	1.660	128.894
UPT Sawangan	± 100	629	159.613
UPT Cipayung	± 300	1.821	165.361
UPT Cilodong	± 250	725	151.866
UPT Tapos	± 150	1.547	280.121

Source: <https://depokkota.bps.go.id/dynamictable/2018/07/20/18/jumlah-penduduk-dan-rasio-jenis-kelamin-menurut-kecamatan-di-kota-depok-2017.html>(Badan Pusat Statistik Kota Depok, 2017)

On the other hand, the average number of patients coming per day is not always proportional to the total amount of hazardous medical waste produced. Each puskesmas provides a different type of service based on the type of poly or service space they have. Not all actions for patients excrete medical waste, for example, is the need for sick letters, counseling, and others. In the Maternal and Child Health (KIA) polyclinic in addition to providing outpatient services in the health sector concerning the care and maintenance of pregnant women, postpartum, breastfeeding mothers also serve counseling that does not produce significant waste. Another factor that influences the amount of hazardous medical waste generation is the type of disease, the needs of patients. In addition, Puskemas also has a field program that produces waste and is accommodated in the Puskesmas.

The information on types of medical waste hazardous is disaggregated, the service sources and composition of medical waste are sharp and non-sharp medical waste in 11 UPT Puskesmas in Depok City is presented in Table 2.

Table 2: Types and Composition of Sharp Medical Waste and Non-Sharp Medical Waste of 11 UPT Puskesmas in Depok City

No	Waste Type	Source	Composition
1.	Sharp Medical Waste	General Poly, Dental Poly, Toddler Poly, Maternity Room, Laboratory, MCH, Pulmonary TB, ER, Inpatient Room, Immunization Room	Used needles on a hypodermic syringe or needle, Pasteur pipette and stick for diabetes mellitus examination

No	Waste Type	Source	Composition
2.	-Non-Sharp Medical Waste	General Poly, Dental Poly, Toddler Poly, Maternity Room, Laboratory, MCH, Pulmonary TB, ER, Inpatient Room, Immunization Room	Used syringes, vials, cotton, masks and gauze, urine pots, pots of sputum from TB tests, gloves, waste results during labor and all medical equipment contaminated by the patient's blood.

The occurrence of medical wastes both sharp and non-sharp medical waste that was measured turned out to give mixed results between one health center and another. The following are sources of activities that have the potential to produce sharp and non-sharp medical waste.

The results of the measurement of the sharp and non-sharp medical waste generation carried out at 11 UPT Puskesmas in Depok City can be seen in the following figure:

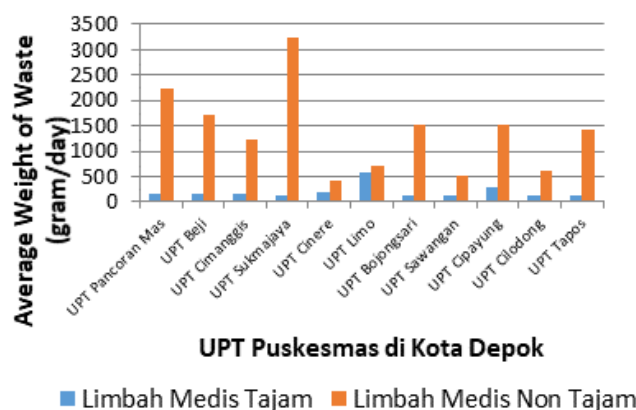


Figure 1: The Comparison of Sharp Sharp Medical Waste (*Limbah Medis Tajam*) and Non-Sharp Medical Waste (*Limbah Medis Non-Tajam*) in Puskesmas in Depok City

Based on the graph above, non-sharp medical waste is always more produced by all UPT Puskesmas in Depok City compared to sharp medical waste. Based on observations made in the field, this significant difference is caused by many types of health service activities that do not use sharp objects such as injections or other tools. The use of syringes per day on a large scale is only done when there are other large-scale immunizations and medical examinations.

Based on the graph, the composition of non-sharp hazardous medical waste ranges from 55% to 96%. In accordance with the average number of patients coming, the highest number of non-sharp medical waste generation is found in the UPT Puskesmas Sukmajaya, which is 3,231 grams/day with an average patient coming in 300 people per day. The smallest incidence is 408 grams/day at the Cinere Health UPT with the average number of patients coming in at 100.

The highest sharp medical waste generation is not produced from health centers with a total of hazardous medical waste and the highest number of patients coming. The sharpest medical waste is produced from UPT Puskesmas Limo, which is 594 grams/day. The average number of patients coming to UPT Puskesmas Limo is 150 people with the type of medical waste that is caused in the form of needles, cotton, and bandages. Therefore, the ratio of medical waste is sharp and the non-sharp medical waste of the puskesmas is not very significant. UPT with the least amount of sharp medical waste generation is the Cilodong Community Health Center, which is 116 grams/day. The average number of UPT Cilodong patients came as many as 250 people with the type of medical waste that was caused only in the form of gloves, cotton and masks. Both puskesmas have laboratory and MCH facilities. Limo UPT Puskesmas has other facilities in the form of action rooms and Posyandu rooms, while Cilodong Puskesmas UPT has general poly facilities and dental poly. High medical waste in the form of needles and syringes was also generated from outside activities of puskesmas, such as in posyandu building and injections in primary schools that were being carried out by the puskesmas.

The most significant non-sharp waste portion was seen in the Sukmajaya Puskesmas UPT, which was 3,231 grams/day (96%). This is because Sukmajaya Subdistrict is the busiest public health center with a relatively larger number of patients with the type of service space in the form of laboratories, phoned emergency rooms, dental polyclinics, toddler

polyclinics, and MCH. The type of patient service provided does not produce significant sharp waste. The services provided by the UPT Puskesmas Sukmajaya cover several categories, such as general examinations and emergency services and there is a 24-hour service policy

Hazardous Medical Solid Waste Reduction and Sorting

The initial stages of management are waste reduction and sorting. Supporting the sampling data analysis above, of the 11 closed statements about the sorting and reduction of hazardous waste proposed in this study, in general, the Puskesmas in Depok have carried out the sorting and reduction of hazardous waste.

At the reduction stage, Puskesmas in Depok have used digital or electronic thermometers compared to mercury. Depok Health Center has also monitored the distribution of chemicals in work units from use to disposal. The results also show that Depok Health Center has procured a small number of products or chemicals and always examines the expiration date of the products that have been purchased. Puskesmas also has segregated hazardous waste with Nonhazardous as well as the collection officers have used personal protection equipment in sorting hazardous and nonhazardous waste.

However, the results of the study also show that cooperation with equipment suppliers regarding the reduction of packaging products so as not to cause hazardous waste is still lacking. This is indicated by the mean value of 3.4, automatically classified in criterion 3 that is less agree and have a score of 3.

In addition, Depok Health Center has used a tool cleaning method using steam disinfection, as well as the use of the FIFO (First In First Out) system in the use of products or chemicals, although it is still not optimal. The use of glass products compared to plastic using steam disinfection is still not optimal.

The results showed that several Puskesmas in Depok had not used steam disinfection rather than chemical disinfection in the cleaning process of the appliance. Though this method is safer and can extend the life of the equipment. With this method, the equipment can be used several times and can reduce the use of chemicals that can cause the emergence of hazardous waste.

Likewise with the use of the FIFO system in the use of products or chemicals. This shows that some Puskesmas in Depok have not used the FIFO system in the use of products or chemicals. Even though the FIFO system will keep products and chemicals always maintained because the first purchase will be issued (used) first so that it will not expire which will cause hazardous waste.

The use of glass products compared to plastic because it can be reused after cleaning the appliance using steam disinfection shows that some Puskesmas in Depok have not used glassware that can be cleaned and reused. By using glass equipment, the equipment can be used several times so that it is not used once that can cause hazardous waste.

Hazardous Medical Solid Waste Storage at Depok City Health Center

The results of the research show that out of 8 statements about the storage of hazardous waste submitted in this study, in general, Puskesmas in Depok has carried out the storage of hazardous waste. This is seen from the 8 statements about the storage of hazardous waste proposed in this study, with the majority mean value of 4, automatically classified in criterion 4 namely agree and have a score of 4.

Depok Health Center has stored hazardous waste in a special place and the waste has been packaged according to its type with leak-proof packaging with a maximum packaging volume of $\frac{3}{4}$ waste bag. Plastic bags where hazardous waste has also been made double to avoid leakage. In addition, the packaged wastes are not compacted by hand or foot.

However, the results of the study also showed that some Puskesmas had not used rabbit bonds on the plastic bags of hazardous waste. The rabbit ear tie model is a safe model for storing hazardous waste. The marking of each bag of hazardous waste has not been done optimally in several Puskesmas. Every bag of waste must be marked so that it is easy to sort it out. Not all hazardous wastes are disposed of together, but there are some that require special and different handling such as stockpiling and burning. Thus every bag of hazardous waste must be marked so that it is easy to handle.

Each health center with UPT status as a temporary storage area (TPS) specifically for medical solid waste classified as hazardous waste. The TPS receives waste input not only from Puskesmas itself but also from the UPF Puskesmas that are in the same sub-district as UPT Puskesmas. From the results of monitoring in the field, it turned out that only 1 health center had managed to permit the establishment of a TPS.

If referring to Minister of Environment Regulation No. 56 In 2015, infectious waste, sharp objects, and / or pathology should not be stored for more than 2 (two) days to avoid bacterial growth, putitis, and odor. If stored for more than 2 (two) days, chemical disinfection must be carried out or stored in a refrigerator or cooler at 0° C (zero degrees Celsius) or lower. The condition of TPS in Depok City Health Center did not have a cooler, only limited to the exhaust used to maintain the air circulation. Therefore, it can be said that 100% of TPS conditions do not have a refrigerator or cooler at 0° C (zero degrees Celsius) or lower.

The Transportation of Hazardous Medical Solid Waste at Depok City Health Center

The results showed that out of 10 statements about the transportation of hazardous waste in the Puskesmas to the part of waste submitted in this study, in general, Puskesmas in Depok had carried out the transportation of hazardous waste well. This is indicated by the majority mean value of 4 and the smallest of 3.9. In addition, the replacement of waste bags that are full of new bags has also been smooth and maximal.

However, some Puskesmas in Depok has not collected hazardous waste every day. Whereas the faster collection is better because there is a hazardous waste that must immediately get treatment so that it does not cause danger, such as vomiting of patients. Similarly, the use of tools to transport hazardous waste from parts to parts resistant to scratches and sharp objects. Some Puskesmas in Depok has not used a tool that resists scratches and sharp objects, even though hazardous waste also has to be managed carefully so that it requires a scratch-resistant tool. hazardous waste that requires a tool that is resistant to scratches, among others, is a syringe, scalpel, broken glass equipment. The equipment for transporting hazardous waste is needed so that it is not manual, this will make the work more effective and efficient, besides that the use of an easy-to-clean tool is needed so that it is not used once that will make it easy to become waste.

In addition, several health centers in Depok have not cleaned the tools used in transporting hazardous waste from parts to sections every day. The Equipment for transporting hazardous waste must always be clean in accordance with hygiene and health requirements. Don't let the equipment cause harm to health. Including the completeness of the officers or personnel in transporting hazardous waste. Some Puskesmas in Depok has not provided the officers who carry hazardous waste with the clothes that meet the occupational health and safety standards. This must be considered so as to create a model of hazardous waste handling that is good and in accordance with the standards set by the government.

Because puskesmas cannot process the hazardous medical solid waste which it produces, puskesmas collaborates with third parties in the case of transporting hazardous medical solid waste. The transport of waste carried out by UPF Puskesmas uses a motorbike vehicle or ambulance at the puskesmas. Transportation carried out in this way can pose a risk. In addition, the transport vehicle used is not a special vehicle for transporting hazardous medical solid waste so it is necessary to procure vehicles specifically for hazardous waste transporters whose use is only to transport hazardous medical solid waste and not be used for other purposes as in the ambulance. The frequency of transport from UPF Puskesmas to UPT Puskesmas TPS is determined directly by UPT puskesmas. This is due to the limited capacity of TPT puskesmas and adjusting the transportation schedule by third parties.

The UPF Puskesmas that transports the waste to the TPT Puskesmas UPT always includes the waste data that they submit to the environmental health section of the intended UPT health center. From activities at the field, it is obtained the information relating to the average waste data collected by UPF Puskesmas to the UPT Puskesmas TPS. The waste data can be seen in Figure 2.

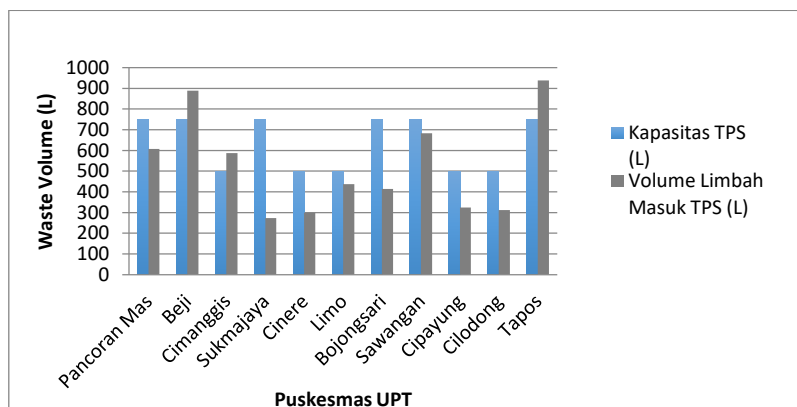


Figure 2: The Comparison of UPT Puskesmas TPS capacity (*Kapasitas TPS*) and the amount of waste entering TPS

CONCLUSION

Based on the research conducted, the following results are obtained.

1. Eleven puskesmas were the sampling points, 36% of Puskesmas had public polyclinics, 90% of Puskesmas had dental polyclinics, 90% of Puskesmas had laboratories 9, 100% of Puskesmas had Maternal and Child Health (KIA) rooms, 27% had pulmonary TB rooms, 18 % have Essential Basic Neonatal Obstetrics Services (PONED), 18% have a delivery room 2 and 36% have an ER.
2. The difference in the completeness of the service space influences the type of action given to patients coming and has the potential to produce the type of composition of hazardous medical waste produced.
3. The number of sub-district residents does not always determine the average number of patients coming from the UPT Puskesmas which ranges from 100-300 patients.

4. With the average number of patients coming in at 300 people/day, Puskesmas UPT Cipayung produced 1,821 grams/day, in contrast to UPT Pancoran Mas and Sukmajaya which produced 2,398 and 3,357.
5. In general Puskesmas in Depok have carried out sorting consisting of sharp medical waste and non-sharp and reduced hazardous waste.
6. The composition of non-sharp hazardous medical waste ranges from 55% to 96%.
7. In general, Puskesmas in Depok has carried out hazardous waste storage. The mean value is mostly 4, automatically classified in criterion 4, that is, agree and have a score of 4.
8. In general, Puskesmas in Depok has carried out transportation of hazardous waste properly. The mean value is mostly as big as 4 and the smallest is 3.9, automatically classified in criterion 4 that is agreed and has a score of 4.

LIMITATION AND STUDY FORWARD

This research is limited to one case that occurred in a health center in Depok. The results of this study can be beneficial for activists and stakeholders. Further research is needed on the identification of the occurrence and composition of hazardous medical waste.

IMPLICATION

The results of this study can be beneficial for activists and stakeholders. Further research is needed the identification of occurrence and composition of hazardous medical waste. This research will contribute to the knowledge of the concept of identification of occurrence and composition of hazardous medical waste.

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