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Analysis of The Impact of Hospital Medical Waste on The Surrounding Environment

Ahmad Nur Sidiq^{1✉}, Nurkayah²

Institut Teknologi Muhammadiyah Sumatera

Email: ahmadproyekyu@gmail.com^{1✉}

Abstrak

Tujuan penelitian ini adalah untuk analisis dampak limbah medis rumah sakit terhadap lingkungan sekitar. Adapun metode penelitian ini adalah penelitian kualitatif, penelitian kualitatif merupakan metode penelitian yang digunakan untuk memahami fenomena sosial secara mendalam. Adapun jenis penelitian yang digunakan oleh peneliti yakni studi kasus, penggunaan studi kasus dikarenakan peneliti dapat memahami secara mendalam konteks, proses, dan kompleksitas fenomena yang sedang diteliti. Jenis penelitian ini memungkinkan peneliti untuk menggali perspektif, pengalaman, dan makna yang mungkin tersembunyi dalam data yang dikumpulkan berkaitan dengan analisis dampak limbah medis rumah sakit terhadap lingkungan sekitar. Kemudian peneliti menganalisis dan menarik kesimpulan untuk menemukan jawaban dari yang peneliti teliti. Hasil dari penelitian limbah medis menyumbang sebanyak 70% pencemaran lingkungan memberikan gambaran serius tentang tantangan yang dihadapi oleh masyarakat global dalam mengelola limbah medi. Disamping itu, manajemen limbah medis rumah sakit memerlukan pendekatan terpadu yang melibatkan regulasi yang ketat, teknologi yang tepat, pendidikan dan pelatihan staf medis, serta keterlibatan masyarakat. Dengan menerapkan praktik terbaik dalam pengelolaan limbah medis, fasilitas kesehatan dapat memainkan peran yang lebih aktif dalam melindungi lingkungan dan kesehatan masyarakat secara keseluruhan.

Kata Kunci: *Analisis, Dampak Limbah Medis, Ligkungan*

Abstract

This research is to analyze the impact of hospital medical waste on the surrounding environment. This research method is qualitative research. Qualitative research is a research method used to understand social phenomena in depth. Case studies are the type of research that researchers use. The use of case studies is because researchers can understand in depth the context, process, and complexity of the phenomenon being researched. This type of research allows researchers to explore perspectives, experiences, and meanings that may be hidden in the data collected relating to the analysis of the impact of hospital medical waste on the surrounding environment. Then the researcher analyzes and draws conclusions to find answers to what the researcher is studying. The results of research on medical waste contributing as much as 70% of environmental pollution provide a serious picture of the challenges faced by global society in managing medical waste. In addition, hospital medical waste management requires an integrated approach involving strict regulations, appropriate technology, education and training of medical staff, and community involvement. By implementing best practices in medical waste management, healthcare facilities can play a more active role in protecting the environment and overall public health.

Keywords: *Analysis, Impact of Medical Waste, Environment*

INTRODUCTION

Managing hospital medical waste is an important aspect of protecting the environment and public health. Abdillah (2022) explained that medical waste is a special type of waste that comes from health services, including hospitals, clinics, medical laboratories, and other health facilities. In the context of hospital medical waste, we can identify various types of waste, the associated risks, and best practices for managing them. According to Andolo et al. (2024), hospital medical waste can be divided into several categories, including solid waste, liquid waste, toxic waste, and infectious waste. Solid waste involves sharp objects such as syringes, used bandages, and single-use medical devices. Liquid waste includes fluids used in medical procedures and equipment cleaning. Toxic waste is often related to chemicals used in medicine and diagnostics. Meanwhile, infectious waste includes materials that can contain pathogens or disease-causing microorganisms.

Hospital medical waste management is becoming increasingly critical due to the increasing amount of waste generated and its impact on the environment and human health. Some of the challenges in medical waste management involve regulatory aspects, waste management technology, and environmental awareness among health practitioners. Regulations related to medical waste management vary greatly in various countries and regions (Arlinda et al., 2022). However, generally, according to Dawu et al. (2022), rules and

guidelines are implemented to ensure that medical waste is handled safely, efficiently, and in accordance with environmental safety norms. Failure to follow regulations can result in serious consequences, including legal sanctions and negative impacts on the health facility's reputation.

Please note that not all medical waste in hospitals is dangerous. Most medical waste is non-hazardous waste that can be processed using conventional waste management methods. Therefore, the first step in medical waste management is to identify and group waste according to its nature (Habibi, 2020). One of the key aspects of medical waste management is waste separation at the source. This involves education and training for medical staff to ensure that waste is properly sorted from the start, as this step not only simplifies the waste management process but also reduces the risk of contamination and ensures that recyclable waste is properly separated.

In addition, the use of appropriate technology is very important in managing medical waste. This technology includes sterilization methods, air protection, and hazardous waste destruction. Autoclaving, for example, is a common method for destroying microorganisms in medical waste using pressurized water vapor. Meanwhile, incineration is used to burn medical waste at high temperatures to avoid the risk of infection and ensure effective destruction (Nursamsi et al., 2017). In some cases, a recycling approach may also be adopted for certain medical waste. For example, some types of non-hazardous medical waste, such as glass, plastic, and paper, can be recycled after proper processing. However, it is important to understand that not all medical waste can be recycled, especially waste that is contaminated or hazardous.

Therefore, hospitals need to provide education and training for medical staff in managing waste because it is a key element in managing medical waste. So medical personnel need to understand the importance of separating waste, using appropriate containers, and the safety measures required when handling medical waste. Effective training programs can help increase awareness and minimize the risks associated with medical waste management (Pradnyana & Mahayana, 2020). Another aspect that needs to be considered in medical waste management is the development of an emergency plan, which involves planning for handling medical waste in emergency situations such as natural disasters or other unexpected events. Emergency plans should include steps to involve appropriate personnel, properly secure waste, and report the incident to the appropriate authorities (Purwohandoyo, 2018).

In addition, regular monitoring and reporting on the volume and type of medical waste generated is an integral part of waste management. In fact, with good monitoring, healthcare facilities can identify trends in waste production, measure the effectiveness of waste management practices, and make necessary changes to improve overall performance. It should be noted that the main challenges in medical waste management also include financing. Safe and efficient management of medical waste requires investment in infrastructure, staff training, and adequate technology. Research results (Rachmawati et al., 2018) show that health facilities, especially in developing countries, face limited resources that can hinder their efforts to comply with required medical waste management standards.

Furthermore, research by Rahno et al. (2015) makes us aware that environmental analysis of hospital medical waste is a very important step in understanding the impact of health activities on the surrounding ecosystem. Hospital medical waste includes various types of materials, chemicals, and hazardous substances that can have short-term and long-term effects on the environment. Therefore, an in-depth understanding of the environmental impact of medical waste is key to developing sustainable waste management strategies.

One of the most striking impacts of hospital medical waste is the potential for water, soil, and air pollution. Liquid waste resulting from various medical processes, such as cleaning medical devices and disposing of body fluids, can contain dangerous chemicals and pathogens. If this liquid waste is not properly treated before disposal, it can cause groundwater and river pollution, threatening water ecosystems and groundwater resources that are vital for human and animal life. (Rizaldi et al., 2019).

According to Satrianegara (2016), in the context of land, solid medical waste, such as used syringes and bandages, has the potential to pollute the land around health facilities. Hazardous chemicals that may be present in medical waste can seep into the soil and create a contamination risk that can have a negative impact on environmental sustainability. Therefore, environmental impact analyses must take into account the potential spread of medical waste on land and how it may affect local ecosystems. Air pollution is also an impact that needs to be considered. The process of burning medical waste, especially if using inadequate methods, can release harmful pollutants into the air. Gases and particles produced during the burning of medical waste can pollute the surrounding air and have a negative impact on air quality as well as the health of humans and animals that breathe in the air.

Apart from direct physical impacts, hospital medical waste can also have ecological and biological impacts on local flora and fauna. Dangerous chemicals contained in medical waste can damage biodiversity and affect the life cycle of organisms in the surrounding environment. This condition can create an ecological imbalance that can cause long-term damage to the ecosystem (Sirait et al., 2016).

In some cases, Tenriawi (2023) explains that medical waste can cause changes in plants and soil microorganisms, disrupting the function of natural ecosystems. In particular, the use of chemicals in medical procedures and treatments can damage soil structure and reduce soil fertility, which in turn can have a negative impact on agriculture and local food production. The environmental impact of hospital medical waste can also include aspects of human health. Contamination of groundwater and air by medical waste can endanger human health for those who depend on these water and air resources. In addition, if medical waste is not managed properly, the risk of disease transmission can increase, threatening communities around health facilities.

As for long-term impacts, medical waste that is not processed properly can cause the buildup of dangerous substances in the surrounding environment. The accumulation of these dangerous chemicals can lead to environmental poisoning and endanger the sustainability of local ecosystems. In addition, long-term impacts also include potential impacts on global climate balance, especially if medical waste contains materials that can accelerate climate change. In the context of climate change, the analysis of the impact of hospital medical waste must also consider the carbon footprint of the waste management process. The process of sterilizing, burning, and transporting medical waste can produce greenhouse gas emissions that contribute to global warming. Therefore, sustainable medical waste management must also take into account efforts to reduce the carbon footprint and minimize the impact of climate change. Based on this explanation, researchers are interested in conducting research with the title *Analysis of the Impact of Hospital Medical Waste on the Surrounding Environment*.

RESEARCH METHOD

The research method used in this research is qualitative research. Qualitative research is a research method used to understand social phenomena in depth. Qualitative research does not just describe phenomena but also seeks to understand the meaning and context of these phenomena (Yusanto, 2020). Case studies are the type of research that researchers use. The use of case studies is because researchers can understand in depth the

context, process, and complexity of the phenomenon being researched (Iswadi et al., 2023). This type of research allows researchers to explore perspectives, experiences, and meanings that may be hidden in the data collected relating to the analysis of the impact of hospital medical waste on the surrounding environment. The results of case study research can provide in-depth, contextual, and detailed insights about the cases studied, which can be used to inform policy, practice, or further theory development (Andry B., 2023).

RESULT AND DISCUSSION

Based on data studies showing that medical waste contributes as much as 70% of environmental pollution, this highlights the high impact of medical waste on ecosystem balance and environmental health (Wijaya et al., 2021). This statement underscores the need for focus and serious action in managing medical waste to reduce its negative impact on the environment. Therefore, we will explore in depth how medical waste can have a significant impact on water, land, air, and various other aspects of the environment. It should be emphasized that medical waste includes various types of materials, including solid waste, liquid waste, toxic waste, and infectious waste. Each type of waste has its own characteristics, which can contribute to environmental pollution in different forms. With data showing that medical waste contributes as much as 70% of total environmental pollution, it is important to understand how each type of medical waste contributes to this pollution.

The information that researchers obtained from interviews with medical personnel is that solid medical waste, such as syringes, used bandages, and single-use medical devices, can create significant physical and biological risks to the environment. Syringes that are not disposed of properly can be a danger to cleaning staff and the general public. Additionally, poorly managed medical solid waste can lead to its buildup in landfills, creating further risks to human health and the environment. Liquid waste from healthcare facilities includes fluids used in medical procedures, chemicals, and toxic materials. If this liquid waste is not properly treated before disposal, it can pollute groundwater and rivers, damaging water quality and threatening aquatic life. This water pollution can spread to wider areas and cause detrimental impacts on fragile water ecosystems.

Toxic waste originating from medical waste can contain dangerous chemicals such as mercury, cadmium, and other heavy metals. When these materials reach the environment, either through liquid or solid waste, they can create chronic risks to human health and the environment. The accumulation of heavy metals in soil and water can damage plants, animals, and aquatic organisms, affecting the food chain and causing long-term impacts

that are difficult to repair. Infectious waste, which includes materials containing pathogens or disease-causing microorganisms, has the potential to cause outbreaks and the spread of disease if not managed properly. If infectious waste reaches the environment, it can pose a risk of infection for humans and animals. Improper handling can result in widespread contamination, creating serious challenges to maintaining public health and safety.

Looking at the impact of medical waste on water, pollution is one of the main risks caused by medical waste. Liquid waste from health facilities can contain dangerous chemicals and pathogenic microorganisms that can pollute groundwater sources and rivers. This can not only harm aquatic life but also threaten vital water resources for humans. Medical waste that is not managed properly can create a high "biochemical oxygen demand" (BOD) in the water. A high BOD indicates the presence of organic materials, which can reduce oxygen levels in the water, causing "eutrophication" and affecting the water ecosystem. Increased levels of these nutrients can trigger excessive algae growth, creating unhealthy conditions for other aquatic organisms and triggering a decline in overall water quality.

In addition, medical waste can contain pharmaceutical ingredients that do not break down completely. The presence of drugs and pharmaceutical chemicals in medical waste can create residues that can pollute water and have long-term impacts on aquatic organisms and the health of humans who consume that water. The abundant use of antibiotics and other drugs in medical waste can also create antibiotic resistance in the environment, posing a serious threat to human and animal health. The impact of medical waste on soil should also be a serious consideration in environmental impact analysis. Solid medical waste that is not managed properly can pollute the soil and create health risks for humans and animals that come into direct contact with the soil. Medical solid waste containing hazardous chemicals can seep into the soil, damaging the soil structure and creating conditions unsuitable for plant growth.

According to Abadi (2022), soil contaminated by medical waste can also experience a decrease in fertility and productivity. Harmful chemicals that reach the soil can damage soil microorganisms that are important for natural nutrient cycles. This can reduce the soil's ability to support agriculture and overall plant growth. Therefore, medical waste not only creates direct risks to human health but can also undermine the sustainability of agricultural and food systems. Meanwhile, in the air context, according to Fathori (2023), burning medical waste is the main source of greenhouse gas emissions and dangerous air pollutants. The process of burning medical waste can produce dangerous chemical compounds such

as sulfur dioxide, nitrogen oxides, and fine particles, which can damage the quality of the air. This air pollution can cause respiratory and human health problems and contribute to global climate change.

Therefore, based on the results of interviews with medical personnel, it was found that the carbon footprint of the medical waste management process is also an important factor in environmental impact analysis. This is in line with what was stated by Habibi (2020): that the process of sterilizing, burning, and transporting medical waste can produce carbon emissions, which can have an impact on climate change. Therefore, in an effort to reduce the impact of medical waste on the environment, it is necessary to invest in green technology and sustainable practices that can reduce the carbon footprint of the entire life cycle of medical waste.

Meanwhile, from a long-term perspective, Rahno et al. (2015) explained that the environmental impact of medical waste could threaten the sustainability of the ecosystem and overall human health. The increasing volume of medical waste generated by population growth and advances in medical technology demands a comprehensive approach to managing medical waste. This includes the implementation of broader recycling practices, innovative waste management technologies, and public education to raise awareness about the importance of responsible medical waste management.

According to the results of interviews and field observations, effective medical waste management also involves strict enforcement of regulations and continuous monitoring of waste management practices in health facilities. Strict sanctions for violations of regulations can help encourage the implementation of sustainable practices in medical waste management. Apart from that, promoting the latest innovations and technologies in medical waste management can also help reduce environmental impacts. In addition, the importance of education and training for medical staff and cleaners should not be ignored. Raising awareness of the consequences of irresponsible medical waste management can result in positive behavioral changes throughout the medical waste production and management chain.

The resources required to effectively manage medical waste must also be considered. Investments in advanced waste management facilities and green technologies may require significant financial support. Therefore, there needs to be a balance between the need to reduce the impact of medical waste on the environment and the availability of resources to implement it. Community and stakeholder involvement is also crucial in addressing the environmental impacts of medical waste. Public education campaigns and active

participation from community groups can help create awareness and motivate behavioral change towards more responsible medical waste management.

When looking to the future, innovation in medical waste management is key. Research and development of new technologies that are more environmentally friendly and efficient in managing medical waste need to be encouraged. This includes the development of more advanced recycling methods, safe waste processing technologies, and technology-based approaches to monitor and trace the footprint of medical waste. Apart from that, the role of the community and public awareness is also important in supporting sustainable medical waste management efforts. Public education campaigns can help change behavior and create understanding about the importance of good medical waste management. The public needs to understand that medical waste that is not handled properly can pose a serious threat to the environment and human health.

It is important to know that awareness of the environmental impact of hospital medical waste has driven innovation in waste management practices. Many healthcare facilities have shifted to more environmentally friendly waste management methods, including the use of green technology, adoption of recycling practices, and investment in advanced waste management systems. One emerging approach is the "green hospital" concept, which prioritizes sustainable practices throughout hospital operations. This involves selecting more environmentally friendly materials, efficient use of energy, and more responsible waste management. Green hospitals aim to reduce their environmental impact, including the impact of medical waste, in a holistic and sustainable way.

In concluding the environmental impact analysis of hospital medical waste, it is important to emphasize that this challenge can be overcome through a holistic approach involving various stakeholders. These steps involve an in-depth understanding of the impact of medical waste on water, soil, air, and local flora and fauna. With this understanding, communities and health professionals can work together to develop solutions that are effective, sustainable, and in line with environmental conservation goals.

CONCLUSION

Based on the results of the previous analysis and discussion, it can be concluded that, in conclusion, the data showing that medical waste contributes as much as 70% of environmental pollution provides a serious picture of the challenges faced by the global community in managing medical waste. With a deep understanding of the impact of medical waste on water, land, air, and human health, proactive and comprehensive

measures need to be taken to minimize its negative impacts. Collaboration across sectors and stakeholders is needed to create sustainable, innovative, and durable solutions to support environmental health and the sustainability of human life. In addition, hospital medical waste management requires an integrated approach involving strict regulations, appropriate technology, education and training of medical staff, and community involvement. By implementing best practices in medical waste management, healthcare facilities can play a more active role in protecting the environment and overall public health.

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