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REVIEW ARTICLE

Hospital liquid waste treatment: a review

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Abstract

Hospital activities affect the condition of the waste produced, especially liquid waste, which can cause environmental pollution and cause health problems. Hospital waste comes from waste from the nutrition kitchen and canteen, laundry, laboratory, x-ray, and radiotherapy. Therefore, it is necessary to manage hospital wastewater properly and correctly, so that the hospital environment becomes healthy, comfortable, and sustainable. This study on the processing of hospital liquid waste uses a literature review method. The population is 3 (three) journals. The keywords used are hospitals, wastewater, IPAL. Analysis using PICOS. Results: This study conducted data analysis on several previous studies aimed at obtaining the results of the study so that they were able to find facts that could be used as evidence. Based on the table above, it can be seen that of the 3 (three) journals, 1 (two) of them did not meet the quality standards for hospital liquid waste and 2 (two) of them met the quality standards for hospital liquid waste. Management of hospital liquid waste in Indonesia. Wastewater from the nutrition kitchen, laundry, and laboratory must undergo special treatment before going to the IPAL. In the IPAL, processing is carried out until the wastewater meets the standard for liquid waste quality and is suitable for release into the environment.

Keywords: Hospital, Wastewater, IPAL.

INTRODUCTION

Hospital waste can cause infectious diseases and pollution, can be in solid, liquid, or gas form. Hospital activities affect the condition of the waste produced, especially liquid waste, which can cause environmental pollution and cause health problems (Firdaus, 2021). Hospital waste comes from waste from the nutrition kitchen and canteen, laundry, laboratory, x-ray and radiotherapy (Kausar et al., 2023). Liquid waste has a waste standard that can be discharged into the environment, which is called the liquid waste quality standard. The hospital liquid waste quality standard is the maximum limit of liquid waste that is allowed to be discharged into the environment from a hospital activity (Decree of the Minister of State for the Environment No. 58 of 1995 concerning Liquid Waste Quality Standards for Hospital Activities)(Hidup, 1995).

According to the Indonesian Minister of Health Regulation No. 7 of 2019 concerning Hospital Environmental Health, wastewater from all sources from hospital buildings/activities must be processed in a wastewater treatment plant (Arisma, 2021). Hospitals are required to provide IPAL (Wastewater Treatment Plant). Pollution in hospitals can occur due to poor wastewater management. Therefore, it is necessary to manage hospital wastewater properly and correctly, so that the hospital environment becomes healthy, comfortable, and sustainable. Good and proper wastewater management can also support the quality of effluent so that it does not exceed the standard for liquid waste and does not cause pollution in the hospital environment (Fitri et al., 2020).

MATERIALS AND METHODS

This research on hospital wastewater treatment uses a literature review method. The population is 3 (three) journals. The keywords used are hospitals, wastewater, IPAL. Analysis using PICOS.

Table 1. Quality of hospital liquid waste

No	Journal	Result
1	Zeswita and Indriati, 2022	Hospital liquid waste that has been processed through the wastewater management stage (IPAL) is disposed of into the final sedimentation tank (fish pond) before being discharged into a public channel connected to the river and flowing into the rice fields. The results of laboratory tests of liquid waste from the hospital have met the standard values for liquid waste quality (COD, BOD, pH, E-Coli, free NH3, PO4).
2	Ningrum and Khalista, 2017	The report on the results of liquid waste testing from the Surabaya Center for Environmental Health Engineering and Disease Control (BBTKLPP) on April 15, 2013 showed that the parameters tested, namely pH, temperature, BOD5, COD, TSS, free NH3, detergent, phenol, residual chlorine, phosphate, and coliform, met the quality standards for hospital liquid waste.
3	Ulfa et al., 2020	(Parameters: E. coli bacteria), (Inlet: 9200/ 100 ml), (Interpretation: M), (Outlet: 1800), (maximum level: 10,000/100 ml). This Mental Hospital in Lampung only carries out standard E-Coli quality checks, this is not in accordance with the established regulations.

Based on table 1, it can be seen that of the 3 (three) journals, 1 (one) of them does not meet the quality standards for hospital liquid waste and 2 (two) of them meet the quality standards for hospital liquid waste.

RESULTS AND DISCUSSION

In this study, data analysis was conducted on several previous studies aimed at obtaining the results of the study so as to be able to find facts that can be used as evidence. Based on the table above, it can be seen that of the 3 (three) journals, 1 (two) of them do not meet the quality standards for hospital liquid waste and 2 (two) of them meet the quality standards for hospital liquid waste. To determine the quality of liquid waste, parameters used, namely physical, chemical, and biological parameters. Physical parameters in the form of temperature and pH, chemical parameters in the form of BOD (Biological Oxygen Demand), COD (Chemical Oxygen Demand), TSS (Total Suspended Solid), free NH3, phosphate, It is said that it does not meet the quality standards for liquid waste because it only carries out quality standard checks on one parameter (Rawis et al., 2022). If the overall quality standard inspection is not carried out, it will damage the environment. Wastewater contains germs, hazardous and toxic substances that can cause disease. The stages of wastewater treatment are as follows:

1. Pretreatment: This stage is the initial stage carried out before liquid waste enters the main processing process. At this stage, the load of liquid waste content will be reduced.
   (a) Kitchen pretreatment. This stage aims to separate fat or solids/garbage carried by liquid waste.

(b) Laundry pretreatment. This stage aims to separate solids (suspended solids/SS), fat, and other dirt.

(c) Metal Precipitator. This stage aims to neutralize and reduce the chemical content in liquid waste from the laboratory.

Cleaning activities, such as removing sediment (sand), need to be carried out to accelerate and smooth the subsequent liquid waste processing process. Units in this stage include a sand trap (grit chamber), a fat and oil trap (skimmer and greasetrap), and an equalization basin. The equalization basin functions to handle the flow rate by stirring the wastewater so that it can enter the IPAL constantly(Yusliani, 2018).

2. Screening Treatment: This stage is the stage where solids/waste carried by liquid waste are filtered, so that the main processing process runs smoothly and the liquid waste pipes are not clogged. Domestic wastewater channels must be closed and separate, each connected directly to the IPAL (Decree of the Minister of Health of the Republic of Indonesia Number: 1204/MENKES/SK/X/2004). Wastewater pipes must be made of non-corrosive materials and resistant to acidic or alkaline conditions (Yusliani, 2018).
3. Equalization: This stage is a stage to homogenize the condition of liquid waste and neutralize the pH of waste using 30 H2SO4 or NaOH. At this stage, an equalization blower is installed to stir the wastewater so that sedimentation does not occur (Yusliani, 2018).
4. Primary Treatment: This stage is the physical processing stage, where wastewater is collected and sent to the main sedimentation tank (Artiyani and Firmansyah, 2016).
5. Secondary Treatment: Second processing, biological processing stage. Liquid waste is flowed into the bio-reactor unit to be processed biologically using the services of aerobic microbes that degrade pollutants. The purpose of this stage is that the liquid waste released into the environment meets the standard quality of liquid waste. Pollutant-degrading microbes are grown in special packing media to optimize activity in liquid waste (Khoiroh, 2020).
6. Tertiary Treatment: Continuation stage if there are still many substances that are dangerous to society (Yusliani, 2018).
7. Alchemy: This stage is the stage to neutralize free NH3 and PO4 in liquid waste, so that the effluent can meet the standard quality of liquid waste (Fitria, 2011).
8. Chlorination: This stage is the stage where liquid waste that has been processed and is suitable for release into the environment will undergo a disinfection process using chlorine to kill residual bacteria (Yusliani, 2018).
9. Organic Reducing Apparatus: This stage is a stage to reduce the risk of river water being contaminated by coliform bacteria in liquid waste (Rachman et al., 2024).
10. Support System: The supporting system can be a fish pond. This supporting system is useful for supporting IPAL, which functions as a bioindicator of IPAL effluent (Hendriarianti et al., 2022).

Environmental pollution in hospitals cannot be eliminated, but can be minimized by processing wastewater effectively and efficiently so that the pollution load entering the environment can be reduced. Liquid waste that has met the hospital's liquid waste quality standards must be met by the hospital, so that the liquid waste released into the environment is safe and does not interfere with the health of the community around the hospital.

Sustainable wastewater management strategies are crucial for mitigating the environmental impact of healthcare facilities. This includes implementing a comprehensive approach that integrates source reduction, waste minimization, and efficient treatment technologies. The first step that needs to be taken is to conduct a thorough evaluation of the existing wastewater treatment system, including

the Liquid Waste Treatment Plant (WWTP). This evaluation should include analysis of the physical, chemical and microbiological parameters of the effluent generated. With regular monitoring, the hospital can identify which parameters exceed the quality standards, such as BOD, COD, and TSS, and take necessary corrective actions.After the evaluation, the hospital needs to optimize the effluent treatment process. One effective method is the implementation of an anaerobic-aerobic biofilter system, which is proven to be able to produce effluent quality that meets environmental standards. This system combines anaerobic processes to reduce organic matter and aerobic to remove residual contaminants, thereby improving effluent treatment efficiency. In addition, the use of chemicals such as alum can also help in reducing total suspended solids (TSS) in the effluent.

Training and capacity building of human resources is also very important. Staff involved in waste management should receive regular training on standard operating procedures (SOPs) and the latest technology in waste treatment. With better knowledge, they will be better able to carry out their duties effectively and minimize errors in the treatment process. Furthermore, strict supervision and management are needed to ensure that all processes go according to plan. Hospital management should be actively involved in effluent quality monitoring and provide sufficient budget support for WWTP infrastructure improvements as well as maintenance of treatment equipment.Finally, it is important to involve external stakeholders, such as the government and surrounding communities, in the effluent management efforts. Through this collaboration, the hospital can gain valuable input and increase transparency in the waste management process (Syafi'i and Amethys, 2016). With these measures, the quality of wastewater effluent in hospitals can be significantly improved, making it safe for the environment and public health.

CONCLUSIONS

Hospital liquid waste management in Indonesia. Wastewater from the nutrition kitchen, laundry, and laboratory must undergo special treatment before going to the IPAL. In the IPAL, processing is carried out until the wastewater meets the standard for liquid waste quality and is suitable for release into the environment. Liquid waste that has met the standard for hospital liquid waste quality must be truly fulfilled by the hospital, so that the liquid waste released into the environment is safe and does not interfere with the health of the community around the hospital.

Author contributions

Achmad Syifa Ul Qulub Al Arifin, Ahmad Jazuly Nabil: Conceptualization, writing draft, writing review, formal analysis and editing.

Conflict of Interest

There is no conflict of interest in this study.

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Data availability

Data related to the findings of this study are available at the corresponding author.

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