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Quality of Liquid Waste at the General Hosital in Makassar

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ABSTRAK

Hospital waste is all waste produced by hospital activities and other supporting activities. Considering the impacts that may arise, good management efforts are needed including tools and facilities, finances and organizational procedures that are determined with the aim of obtaining hospital conditions that meet environmental health requirements. The research used was observational with a descriptive approach, namely to determine the quality of liquid waste in hospitals in Makassar. This research was conducted from 20 to 27 June 2021 at the Hospital in Makassar. The population is liquid waste in hospitals in Makassar in 2021. The sample in this study is hospital effluent waste in Makassar in 2021. Waste water that is not handled properly will result in negative impacts, especially for health, so it needs good management so that when it is disposed of in A certain area does not cause pollution which is supported by the wastewater treatment plant (IPAL) owned by the hospital itself. It was concluded that the DO levels in the liquid waste produced were at a vulnerable level. The BOD level in liquid waste in the morning is at a moderate level and in the afternoon it is at a heavy level. COD levels in Makassar liquid waste in the morning are at moderate levels and in the afternoon at heavy levels. TSS levels in liquid waste in the morning are at moderate levels and in the afternoon they are at heavy levels. The pH level in liquid waste meets the requirements. Temperature levels in liquid waste meet the requirements.

Keywords: Quality, Liquid Waste, Hospital, Makassar

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1. Introduction

Hospital waste can contain various microorganisms depending on the type of hospital. Hospital liquid waste can contain organic and inorganic materials which are generally measured by the parameters BOD, COD, TSS, etc. Meanwhile, hospital solid waste consists of easily decomposable waste, combustible waste, and others. These wastes are likely to contain pathogenic microorganisms or dangerous toxic chemicals that cause infectious diseases and can be spread into the hospital environment due to inadequate health care techniques, mishandling of contaminated materials and equipment, as well as the provision and maintenance of sanitation facilities. which is still bad.

Disposal of this large amount of waste is best done by sorting the waste into various categories. For each type of category, different waste disposal methods are applied. The general principle of hospital waste disposal is to avoid the risk of contamination and injury as far as possible.

Clinic Waste. Waste is generated during routine patient care, surgery and in high-risk units. This waste is dangerous and causes germ infections. Therefore it needs to be clearly labeled as high risk. Examples of this type of waste are dirty bandages or wrappers, body fluids, amputated limbs, used needles and syringes, urine bags, and blood products.

Pathological Waste. This waste is also considered high risk and should be autoclaved before leaving the pathology unit. The waste must be labeled biohazard.

Waste is not a Clinic. This waste includes wrapping paper or bags and plastic that does not come into contact with body fluids. Even though it does not pose a risk of illness, this waste is quite troublesome because it requires a large space to transport and dispose of it.

Kitchen Waste. This waste includes food scraps and dirty water that does not come from places that produce infectious waste. Radioactive Waste. Although this waste

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does not pose an infection control problem in hospitals, its safe disposal needs to be well managed.

As stated in Law no. 9 of 1990 concerning the Principles of Health, every citizen has the right to obtain the highest possible degree of health. These provisions are the basis for the government to carry out activities in the form of preventing and eradicating disease, preventing and controlling pollution, restoring health, providing information and health education to the public.

Efforts to improve public health can be carried out in various ways, namely preventing and eradicating infectious diseases, environmental health, improving nutrition, providing clean water, health education and maternal and child health services. Apart from that, protection against the dangers of environmental pollution also needs to be given special attention.

Hospitals are a means of health improvement efforts that provide health services and can also be used as educational institutions for health workers and research. Health services provided by hospitals include activities to cure patients and restore physical and mental disabilities. Hospital activities produce various kinds of waste in the form of liquid, solid and gas. Hospital waste management is part of environmental health activities in hospitals which aims to protect the public from the dangers of environmental pollution originating from hospital waste. Elements related to the implementation of hospital service activities (including waste management), namely: the initiator or person in charge of the hospital, users of hospital services, experts, specialists and institutions who can provide suggestions, as well as entrepreneurs and the private sector who can provide the necessary means and facilities.

Efforts to manage hospital waste have been implemented by preparing software in the form of regulations, guidelines and policies that regulate the management and improvement of health in the hospital environment. In addition, the Department of Health is gradually and continuously working to install hospital waste management. So to date, some government hospitals have been equipped with waste management

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facilities, although they need to be improved. However, it must be realized that hospital waste management still needs to be improved.

a. Hospital waste processing efforts
b. Waste processing is basically an effort to reduce the volume, concentration or danger of waste, after the production process or activity, through physical, chemical or biological processes. In implementing waste management, the first effort that must be made is preventive efforts, namely reducing the volume of hazardous waste released into the environment, which includes efforts to reduce waste at the source, as well as efforts to utilize waste.
c. The waste minimization program that has just begun to be promoted in Indonesia is still something new for hospitals. The aim is to reduce the amount of waste and process waste that still has economic value. Various efforts have been used to reveal which technology options are best for waste processing, especially hazardous waste, including waste reduction, waste minimization, waste abatement, waste prevention and reduction of waste. source (source reduction).
d. Reducing waste at the source is an effort that must be implemented first because this effort is preventive in nature, namely preventing or reducing the occurrence of waste that comes out of the production process. Waste reduction at the source is an effort to preventively reduce the volume, concentration, toxicity and level of danger of waste that will exit into the environment directly at the source of pollution. This provides many benefits, namely increasing the efficiency of activities and reducing waste processing costs and the implementation is relatively cheap.
e. Various methods used to reduce waste at the source are:

    1) Good housekeeping, this effort is carried out by hospitals to maintain a clean environment by preventing spills, spills or leaks of materials and handling waste as best as possible.
    2) Waste stream segregation, namely separating various types of waste streams according to component type, concentration or condition, so that it can simplify, reduce volume or reduce waste processing costs.

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3) Implementation of preventive maintenance, namely maintenance/replacement of tools or tool parts according to scheduled times.
4) Material management (material inventory) is an effort to ensure that the stock of materials is always sufficient to ensure the smooth running of the activity process, but not excessively so that it does not cause environmental disturbances, while storage remains neat and controlled.
5) Setting good process and operating conditions, in accordance with the operating/tool usage instructions can increase efficiency.
6) The use of clean technology, namely the ownership of activity process technology that has little potential to emit B3 waste with high efficiency, should be carried out when developing a new hospital or replacing some of its units. The codification policy on the use of colors to sort waste throughout the hospital must have appropriate colors, so that waste can be separated at the source, it is necessary to pay attention to the following:
    a) The ward must have two types of waste containers with two colors, one for clinic waste and the other for non-clinic waste.
    b) All waste from the operating room is considered clinical waste.
    c) Waste from the office, usually in the form of stationery, is considered non-clinical waste.
    d) All waste leaving the pathology unit must be considered clinical waste and needs to be declared safe before disposal.

Several things need to be considered in formulating a color codification policy regarding waste separation, including the following:

1. Waste must be separated from its source.
2. All high-risk waste should be clearly labelled.
3. It is necessary to use plastic bags with different colors, indicating where the plastic should be transported for incineration or disposal.

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2. Research Method

The research used was observational with a descriptive approach, namely to determine the quality of liquid waste in hospitals in Makassar. This research population is liquid waste and the sample in this research is hospital effluent waste in Makassar in 2021.

3. Results And Discussions

a. Result

1) DO Parameters

The measurement results based on the DO (Dissolved Oxygen) parameter can be seen in the following table:

Table 3
Wastewater measurement results based on parameters DO
at a Hospital in Makassar

Parameters	Measurement time				Standard (ppm)
	Morning		Evening		
	Vulnerable	Not	Vulnerable	Not	
DO (Dissolved Oxygen)	3,5	-	2,1	-	Vulnerable = ≥ 2 Not = < 2

Source: Primary data

Table 3 shows that the results of hospital wastewater measurements in Makassar in the morning and evening are at vulnerable levels, namely 3.5 ppm in the morning and 2.1 ppm in the afternoon.

2) BOD parameters

The measurement results based on BOD (Biochemical Oxygen Demand) parameters can be seen in the following table:

Table 4
Wastewater measurement results based on parameters
BOD at Hospitals in Makassar

Parameters	Measurement time		Standard
	Morning	Evening	

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	1	2	3	4	1	2	3	4	(mg/l)
BOD	-	216,2	-	-	-	-	439,7	-	**1.** Light < 200 **2.** Medium 200-350 **3.** Weight 350-750 **4.** Very heavy > 750

Source: Primary data

Table 4 shows that the results of measuring hospital wastewater in Makassar based on BOD (Biochemical Oxygen Demand) parameters in the morning were at a medium standard, namely 216.2 mg/l, while in the afternoon it was at a heavy standard, namely 439.7 mg/l.

3) COD parameters

The measurement results based on COD (Chemical Oxygen Demand) parameters can be seen in the following table:

Table 5
Wastewater measurement results based on parameters
COD at Hospital in Makassar

Parameters	Measurement time								Standard (mg/l)
	Morning				Evening				
	1	2	3	4	1	2	3	4	
COD	-	400	-	-	-	469	-	-	1. Light < 400 2. Medium 400-700 3. Weight 700-1500 4. Very heavy > 1500

Source: Primary data

Table 5 shows that the results of measuring hospital wastewater in Makassar based on COD (Chemical Oxygen Demand) parameters in the morning and afternoon are both at medium standards, namely in the morning 400 mg/l, while in the afternoon it is 439.7 mg/l.

4) TSS parameters

Based on the measurement results based on the TSS (Total Suspended Solid) parameter, it can be seen in the following table:

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Table 6
Wastewater measurement results based on parameters
TSS at Hospitals in Makassar

Parameters	Measurement time						Standard (mg/l)
	Morning			Evening			
	1	2	3	1	2	3	
TSS	-	100	-	-	-	112	1. Light < 100 2. Medium = 100 3. Weight > 100

Source: Primary data

Table 6 shows that the results of measuring hospital wastewater in Makassar based on the TSS (Total Suspended Solid) parameter in the morning were at a medium standard, namely 100 mg/l, while in the afternoon it was at a heavy standard, namely 112 mg/l.

5) pH parameters

Based on the results of measurements at the Hospital in Makassar based on the pH parameter (degree of acidity) it can be seen in the following table:

Table 7
Wastewater measurement results based on parameters
pH in Hospitals in Makassar

Parameters	Measurement time				Standard
	Morning		Evening		
	MS	TMS	MS	TMS	
pH	7,25	-	7,25	-	MS = 6,0-9,0 TMS = < 6,0 atau > 9,0

Source: Primary data

Table 7 shows that measurements of hospital wastewater in Makassar based on the pH parameter (degree of acidity) in the morning and evening respectively meet the requirements, namely 7.25.

6) Temperature parameters

Based on the results of measurements at the Hospital in Makassar based on the pH parameter (degree of acidity) it can be seen in the following table:

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Table 8
Wastewater measurement results based on parameters
Temperature in Hospitals in Makassar

Parameters	Measurement time				Standard
	Morning		Evening		
	MS	TMS	MS	TMS	
SUHU	30ºC	-	30ºC	-	MS = 30ºC TMS = > 30ºC

Source: Primary data

Table 8 shows that measurements of hospital wastewater in Makassar based on temperature parameters in the morning and evening meet the requirements, namely 30ºC.

b. Discussion

A hospital is a health care facility that organizes referral health service activities and can function as a place for education of health workers. In providing health services to the community, of course hospitals produce materials that are infectious or non-infectious in the form of gas, liquid and solid. generated from the activities of each unit such as the treatment room, polyclinic room, laboratory, linen washing place, kitchen, bathroom and morgue.

Negative effects that arise as a result of unhealthy environmental conditions due to imperfect management of hospital wastewater include: the presence of pathogenic bacteria that cause disease. Hospital wastewater has the potential to be dangerous to health, so it is necessary to handle wastewater properly and correctly, namely by having a wastewater management installation. Therefore, hospital construction must be accompanied by supervision, monitoring and attention to the hospital waste produced.

Waste water management is the management of all waste originating from hospitals which may contain microorganisms, chemicals and radioactivity (Ministry of Health, 1990). Hospital wastewater management is a very important part of hospital environmental health efforts which have the aim of protecting the public from the dangers of environmental pollution. Waste water that is not handled properly will have a negative impact, especially on health, so it needs good management so that when it is

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discharged into a certain area it does not cause pollution, which is supported by a waste water treatment plant (IPAL) owned by the hospital itself.

Pollutant material is the amount of weight of a pollutant substance in a certain unit of time which is the result of multiplying the pollutant content by the liquid waste discharge (Governor Decree No. 61 of 1999). Parameters used to measure pollutant levels include:

1) DO parameters

   The source of dissolved oxygen in waters comes from the atmosphere. The oxygen content in the air is 20.9%. Oxygen from the atmosphere dissolves into water through diffusion. Other sources of dissolved oxygen are phytoplankton and aquatic plants. These organisms live in the translucent layer of water.

2) BOD (Biochemical Oxygen Demand)

   BOD is an empirical analysis that tries to globally approach the microbiological processes that actually occur in water. BOD examination is needed to determine the pollution load due to waste water and to design biological treatment systems (G. Alerts and SS Santika, 1987).

3) COD (Chemical Oxygen Demand)

   COD is the amount of oxygen (mg O2) needed to oxidize organic substances in 1 liter of water sample, where the oxidizer K2, Cr2, O7 is used as an oxygen source (oxidizing agent) (G. Alerts and SS Santika, 1987).

4) TSS (Total Suspended Solid)

   TSS is the amount of weight in mg/liter of dry sludge that is in waste after being filtered with a 0.45 micron membrane. Determination of suspended solids (TSS) is useful for determining the strength of domestic wastewater pollution, and is also useful for determining the efficiency of water treatment units.

5) Degree of Acidity (pH)

   The degree of acidity is a measure of the concentration of Hydrogen ions and in the atmosphere the water reacts acid/base (Pescod, 1973). The quality standard for hospital liquid waste for pH parameters is in the range of 6.0–9.0.

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6) Temperature

Temperature is the temperature of waste water produced by hospital activities, temperature is an important parameter. Increasing temperature results in increased viscosity, chemical reactions, evaporation and volatilization, apart from that it also causes a decrease in the solubility of gases in water, for example O2, CO2, N2, CH4, and so on (Haslam, 1995).

Based on the research results according to DO parameters, both the first measurement in the morning and the second measurement in the afternoon showed that it was at the vulnerable point.

According to Salmin, 2005, dissolved oxygen (Dissolved Oxygen = DO) is needed by all living organisms for respiration, metabolic processes or exchange of substances which then produce energy for growth and reproduction. Apart from that, oxygen is also needed for the oxidation of organic and inorganic materials in the process. aerobics. The main source of oxygen in waters comes from a diffusion process from free air and the results of photosynthesis of organisms that live in these waters.

The results of the BOD, COD and TSS examinations in the morning were at moderate levels, this was because there was no active activity in all rooms except the inpatient room. Meanwhile, the measurement results in the afternoon were at a heavy level, this was influenced by the results of activities in all rooms in the Makassar Hospital, which were more pronounced from around 10.00 am to 16.00 WITA. The activities in question are outpatient services, inpatient services, services in the emergency department, surgical services, delivery services, radiology, laboratories, laundry and nutrition, resulting in an increase in hospital waste.

The results of this research are in line with research conducted by Wati, 2008, the BOD, COD and TSS parameters in PT Sinar Oleochemical International's waste products are at a heavy level, namely in the range of 700-1500 mg/l.

The results of this research are also in line with research conducted by Rahmawati and Azizah, 2003 on testing wastewater quality before and after processing at Nganjuk Regional Hospital.

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Based on the results of research related to pH parameters, it shows that measurements of hospital wastewater in Makassar based on the pH parameter (degree of acidity) in the morning and evening respectively meet the requirements, namely 7.25. This research is in accordance with research conducted by G. Nugroho Susanto, 2008, et al. That from all treatments the pH still complies with the liquid waste quality standards for hospital activities, namely 6.0-9.0.

Likewise, regarding the TEMPERATURE parameter, measuring hospital wastewater in Makassar based on the TEMPERATURE parameter in the morning and evening meets the requirements, namely 30ºC. This research is in accordance with research conducted by G. Nugroho Susanto, et al, 2008. In temperature measurements after further testing with Beda Least Significant (BNT) $\alpha = 0.05$, there is no significant difference between one treatment and another (Figure 4). The average temperature of all treatments does not exceed the maximum liquid waste quality standard for hospital activities, namely 30 oC.

4. Conclusion

Based on the research results and discussions that have been described, several things can be concluded as follows:

1. DO levels in liquid waste produced by hospitals in Makassar are at a vulnerable level
2. BOD levels in liquid waste produced by hospitals in Makassar in the morning are at moderate levels and in the afternoon are at heavy levels
3. COD levels in liquid waste produced by hospitals in Makassar in the morning are at moderate levels and in the afternoon are at heavy levels
4. TSS levels in liquid waste produced by hospitals in Makassar in the morning are at moderate levels and in the afternoon are at heavy levels
5. The pH level in liquid waste produced by Hospitals in Makassar meets the requirements
6. Temperature levels in liquid waste produced by hospitals in Makassar meet the requirements.

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5. Compliance with ethical standards

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Disclosure of conflict of interest

This research collaboration is a positive thing for all researchers so that conflicts, problems and others are absolutely no problem for all writers.

Statement of informed consent

Every action we take as authors is a mutual agreement or consent.

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