### ABSTRACT

Hospitals produce quality liquid waste that is not by the standard value of quality standards that can pollute the environment. Indonesia is estimated to produce 48,985.70 tons of hospital liquid waste per day. This study aims to determine the quality of inlet and outlet wastewater as well as the methods used by the Wastewater Treatment Plant (WWTP) of Djoelham Hospital, Binjai City. This study used qualitative types with observational methods. The research sample was taken from two points, namely the inlet point and the WWTP outlet point with BOD, COD, TSS, and pH parameters. Sampling technique using Composite Sampling. Data processing and analysis is carried out by statistical means. As well as data presented in the form of tables and line graphs. This research was conducted at Djoelham Hospital in Binjai City from March to May 2023. The results showed that the quality of wastewater in the parameters of BOD, COD, TSS, and pH in the inlet basin was by the quality standards of the Minister of Environment Regulation Number 5 of 2014, except for the value of TSS parameters in April 31 mg/l and May 35 mg/l. The quality of wastewater in the outlet basin based on the STORET method with a total score of 0 is classified as Class A (very good) or has met the quality standard value of the Minister of Environment Regulation Number 5 of 2014. Based on calculations, the average value of effectiveness of BOD (13.53%), COD (11.22%), and TSS (49.79%) was obtained. The WWTP method uses 2 methods, the aerobic and anerob methods. It is expected that the hospital will check the quality of inlet and outlet wastewater at least once every 1 month by PERMENLH Number 5 of 2014.

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### Keywords:
- Hospital
- IPAL
- Liquid Waste
- Wastewater Quality

### INTRODUCTION

A hospital is an institution designed as a health service unit operated for the community and must be maintained every aspect of human health, and environmental health. Environmental health includes physical hygiene, solid waste, liquid waste, and clean water used (Makaraung et al., 2022).

Based on data from the American Hospital Association (AHA), the number of hospitals in the U.S. or United States of America in 2020 was 5,139 hospitals, consisting of 3,343 general hospitals and 1,796 regional hospitals. In Indonesia alone, the number of hospitals based on the Central Statistics Agency (BPS) is 2,514 General Hospitals (RSU) and 598 Regional Hospitals (RSD), while in North Sumatra there are 196 General Hospitals and 26 Regional Hospitals.
In carrying out its functions, the Hospital interacts a lot with the environment and produces waste that is not by standard quality standards. By the Regulation of the Minister of Health of the Republic of Indonesia Number 7 of 2019 concerning Hospital Environmental Health, every hospital must carry out waste and radiation security. The implementation of waste security in the Hospital includes securing domestic solid waste, hazardous and toxic waste, liquid waste, and gas waste. Indonesia is estimated to produce hospital solid waste of 376,089 tons/day and liquid waste production of 48,985.70 tons/day. The results of the 2002 Rapid Assessment conducted by the Directorate General of P2MPL Directorate of Water Supply and Sanitation involving District and City Health Offices, stated that out of 1,476 existing hospitals only 648 hospitals (36%) had Wastewater Treatment Plants (WWTP). Of the 648 hospitals, only 52% of hospitals can treat their wastewater properly with the quality of treated wastewater that meets quality standards (Nurhaliq, et al., 2022).

Djoelham General Hospital Binjai City is one of the treatment centers for the people of Binjai City. However, the last time the wastewater quality inspection was carried out was in April 2022. The Regulation of the Minister of Environment Number 5 of 2014 concerning Wastewater Quality Standards Article 16 states that every industry and/or activity by Article 3 paragraph 1, monitor wastewater quality at least once (1) every month according to predetermined parameters. As well as the condition of the WWTP that has been established since 2011, with turbid inlet and outlet color conditions and the foul smell from the resulting inlet. It is doubtful that there is an impact of WWTP on the quality of wastewater that will be discharged into community drainage. Based on the results of the presentation, researchers are interested in conducting research at the Wastewater Treatment Plant (WWTP) of Djoelham Hospital, Binjai City.

Based on the background, researchers are interested in conducting research at the Djoelham Regional General Hospital Wastewater Treatment Plant on the quality of inlet and outlet wastewater and the method of the Wastewater Treatment Plant (WWTP) used.

RESEARCH OBJECTIVES

1. **General Purpose**
   Knowing the quality value of inlet and outlet wastewater as well as the methods used in the Wastewater Treatment Plant (WWTP) of Djoelham Regional General Hospital, Binjai City.

2. **Special Purpose**
   a. Knowing the method used by the Wastewater Treatment Plant (WWTP) at the Djoelham Regional General Hospital in Binjai City
   b. Knowing the quality of wastewater at the inlet based on BOD, COD, TSS, and pH parameters at the WWTP Djoelham Regional General Hospital Binjai City
   c. Knowing the quality of outlet wastewater based on BOD, COD, TSS, and pH parameters at the WWTP Djoelham Regional General Hospital Binjai City
   d. Knowing the value of the effectiveness of the performance of the Wastewater Treatment Plant (WWTP) of the Djoelham Regional General Hospital Binjai City

METHOD

The type of research used is qualitative research using observational methods. This research was conducted by observation (observation) and comparing laboratory test results with established quality standards. The research location was carried out at the Wastewater Treatment Plant (WWTP) of the Djoelham Regional General Hospital, Binjai City. The study was conducted from March to May 2023. The overall wastewater population of Djoelham Regional General Hospital Binjai City. The sample in this study was determined by two points, namely point I at the Inlet and point II at the Outlet of the Wastewater Treatment Plant (WWTP) RSUD Djoelham Kota Binjai. This sampling technique uses Composite Sampling (combined time), which is a technique taken from one location point at different times with the same volume (SNI 6989.59: 2008). This study has primary data and secondary data. The primary data in this study was the results of an examination of wastewater samples in the BTKLPP Class I Medan laboratory against BOD, COD, TSSS, and pH parameters. The secondary data of this study are the WWTP flow diagram at Djoelham Hospital and the floor plan of Djoelham Hospital Binjai City. The tools used in the study were cameras, sample storage containers with a size of 1.5 liters, and litmus paper. The research instrument used is a guideline for observation of the Wastewater Treatment Plant carried out (Silalahi, J Elizabet 2016). Inlet Data Analysis: Report laboratory test results are analyzed for each key parameter with liquid waste quality standards based on the Minister of Environment Regulation No. 5 of 2014 concerning Wastewater Quality Standards.
Outlet Data Analysis: Outlet data will be analyzed based on the Indonesian Government regulation, namely the Decree of the Minister of Environment Number 115 of 2003, concerning Guidelines for Determining the Status of Water Quality Standards using the STORET method.

WWTP Effectiveness Analysis: Analysis of effectiveness measurement in hospital WWTP is characterized using pollution removal percentage. The calculation of the percentage of pollution removal is based on the quality of wastewater at the inlet and outlet of the Hospital WWTP.

\[
\% \text{Removal} = \frac{\text{nilai parameter outlet} - \text{nilai parameter inlet}}{\text{nilai parameter inlet}} \times 100\%
\]

Then the calculation results can be categorized as follows: (Susanti et al. 2020)

- Very efficient: \( x > 80\% \)
- Efficient: \( 60\% < x \leq 80\% \)
- Quite efficient: \( 40\% < x \leq 60\% \)
- Less efficient: \( 20\% < x \leq 40\% \)
- Inefficient: \( x \leq 20\% \)

**DISCUSSION**

1) **Wastewater Treatment Plant System (WWTP) Djoelham Regional General Hospital Binjai City**

The wastewater treatment system of Djoelham Regional General Hospital Binjai City uses a combination of aerobic and anaerobic systems. The sequence of WWTP performance process of aerobic and anaerobic combination methods is divided into 2 (two), namely primary processing and secondary processing. (Ministry of Health RI. 2011)

Primary processing consists of processes: collection banks, screens or filters to separate solid impurities, sand separation baths or grid chambers, grease traps, equalization baths

Secondary treatment consists of standard units or equipment in aerobic and anaerobic biofilters: initial settling basins, biofilter anaerobic ponds where wastewater is decomposed by microorganisms anaerobically, biofilter aerobic ponds where wastewater decomposition by microorganisms aerobically, final settling basins, air supply equipment such as blowers and air diffusers, stirring systems such as to make a mixture of microorganisms and wastewater homogeneous and not prevent precipitation sludge in biofilter aerobic ponds. This system does not need to be done if the air supply is large enough and no precipitation occurs. Air is channeled through the blower pump (diffused) or through mechanical aeration. Microbial cells form floc that will settle in the biofilter aerobic pool media.

2) **Inlet Wastewater Quality**

- **BOD (Biological Oxygen Deman)**

  The results of the BOD examination in the inlet basin are compared with the value of the PERMENLH No. 5 Year 2014 Quality standard, which can be seen in the following table.

<table>
<thead>
<tr>
<th>Moon</th>
<th>Hasil BOD (Biological Oxygen Deman)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baku Mutu</td>
</tr>
<tr>
<td>Maret</td>
<td>50</td>
</tr>
<tr>
<td>April</td>
<td>50</td>
</tr>
<tr>
<td>From</td>
<td>50</td>
</tr>
</tbody>
</table>

The results of the BOD Parameter Examination at the inlet showed that the BOD content in the inlet bath in March was 5.3 mg/l, in April it decreased to 5.2 mg/l and in May it was 5.2 mg/l. The content of BOD is classified as a safe category because it does not exceed the quality standard value set by the Minister of Environment Regulation, which is 50 mg/l.

This research is in line with research conducted by (Made et al. 2020) at the Limba Water Treatment Plant at RSUD dr. R. Goeteng Taroenadibrata Purbalingga 2015 obtained the results of the BOD value at the inlet in April 2015 showed a figure of 40.63 mg/l with an outlet result of 25.03 mg/l with an efficiency value of 38.3%.
COD (Chemical Oxygen Demand)

The results of the COD examination in the inlet basin are compared with the quality standard value of the Minister of Environment Regulation No. 5 of 2014, which can be seen in the following table:

<table>
<thead>
<tr>
<th>Moon</th>
<th>Hasil Tes COD (Chemical Oxygen Demand)</th>
<th>Baku Mutu</th>
<th>Inlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maret</td>
<td></td>
<td>80</td>
<td>17.6</td>
</tr>
<tr>
<td>April</td>
<td></td>
<td>80</td>
<td>21.8</td>
</tr>
<tr>
<td>From</td>
<td></td>
<td>80</td>
<td>19.7</td>
</tr>
</tbody>
</table>

Based on the results of laboratory tests of the COD parameter content (Chemical Oxygen Demand) at the inlet of the Djoleham Regional General Hospital in Binjai City has a COD content in March of 17.6 mg / l, April 17.2 mg / l and May 17.1 mg / l. Quality Standard COD content for wastewater based on the Regulation of the Minister of Environment No. 5 of 2014 is 80 mg / l. The COD content in the inlet is categorized as safe.

The decrease in COD is due to deposition in the aeration basin. The aeration process in wastewater can reduce the unpleasant taste and odor caused by organic compounds and also move volatile components, including volatile organic compounds that are toxic.

This research is in line with the results of research conducted by (Kalamu, Dian M. Tony K. Timpua 2014) at the Mental Hospital Prof. Dr. L. V. Ratumbuysang Manado City with the average result of COD content at the Hospital inlet of 66 mg / l and the average COD content at the outlet of 16 mg / l.

TSS (Total Suspended Solid)

The results of the TSS examination in the inlet basin are compared with the quality standard value of the Minister of Environment Regulation No. 5 of 2014, which can be seen in the following table:

<table>
<thead>
<tr>
<th>Moon</th>
<th>Hasil Tes TSS (Total Suspended Solid)</th>
<th>Baku Mutu</th>
<th>Inlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maret</td>
<td></td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>April</td>
<td></td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>From</td>
<td></td>
<td>30</td>
<td>35</td>
</tr>
</tbody>
</table>

The results of the inlet wastewater laboratory test at the Djoleham Regional General Hospital in Binjai City on the content of TSS parameters have increased. TSS results in March of 25 mg / l increased in April by 31 mg / l and continued to rise in May by 35 mg / l.

The content of TSS parameters at the inlet in April and May is classified as exceeding the threshold. By the provisions of the Regulation of the Minister of Environment of the Republic of Indonesia No. 5 of 2014, the TSS content in water is 30mg / l.

Research (Atima 2015) says, that if the TSS value increases significantly, then the TSS content will have a turbid impact and seem dirty so that of course it reduces the usefulness of water.

Ph

<table>
<thead>
<tr>
<th>Moon</th>
<th>Hasil Tes (Total Suspended Solid)</th>
<th>Baku Mutu</th>
<th>Inlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maret</td>
<td></td>
<td>6 – 9</td>
<td>8</td>
</tr>
<tr>
<td>April</td>
<td></td>
<td>6 – 9</td>
<td>8</td>
</tr>
<tr>
<td>From</td>
<td></td>
<td>6 – 9</td>
<td>8</td>
</tr>
</tbody>
</table>

Based on the results of the pH Parameter Examination (pouvoir Hydrogen) at the inlet, the results of the inlet wastewater test at the Djoleham Regional General Hospital in Binjai City using litmus paper on the pH parameter content showed results from March to May had a pH content of 8. The pH content in the inlet is classified as a safe category because it is by the provisions of the Minister of Environment Regulation Number 5 of 2014, namely the pH content of 6 to 9.

Very acidic water conditions or alkaline will hurt the survival of organisms because it will cause the mobility of various toxic heavy metal compounds. If water experiences an acid-base change in waters from the pH value, it will disrupt aquatic biota or aquatic ecosystems and reduce the use value of water. (Atima 2015)
3) Outlet Wastewater Quality

The results of laboratory tests at the outlet of the Binjai City Regional General Hospital can be classified using the STORET method, presented in the following table:

<table>
<thead>
<tr>
<th>No</th>
<th>Parameter</th>
<th>Unit</th>
<th>Baku Mutu</th>
<th>Measurement Results</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Maximum</td>
<td>Minimum</td>
</tr>
<tr>
<td>1</td>
<td>Kimia</td>
<td>BE</td>
<td>50</td>
<td>5.2</td>
<td>4.9</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>COD</td>
<td>80</td>
<td>17.2</td>
<td>16.1</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>TSS</td>
<td>30</td>
<td>21</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>pH</td>
<td>6 - 9</td>
<td>7.5</td>
<td>7.5</td>
</tr>
</tbody>
</table>

The results of the classification of outlet wastewater laboratory tests of the Djoelham Regional General Hospital in Binjai City using the STORET method by the Decree of the Minister of Environment No. 115 of 2003 show the results of the number of scores obtained, namely 0. This shows that the outlet wastewater of Djoelham General Hospital Kota Binjai has good quality and belongs to Class A (very good) or meets quality standards for BOD, COD, TSS, and pH parameters.

4) Effectiveness of Wastewater Treatment Plant (WWTP)

The results of inlet and outlet data analysis to measure the effectiveness of the Wastewater Treatment Plant (WWTP), can be detailed as follows:

1. The effectiveness value of WWTP on BOD parameters in March was 7.54%, in April 21.21% and in May 11.86%. The average effectiveness is 13.53% and is categorized as inefficient. The effectiveness value of WWTP is not efficient because the BOD content in inlet wastewater shows results below the established quality standards.
2. The effectiveness value of WWTP in COD parameters in March was 8.52%, in April 21.1% and in May was 4.06%, with an average of 11.22%. The value of efficiency in reducing COD content is still relatively inefficient. However, if you look at the results of laboratory tests on WWTP wastewater at Djoelham Hospital, Binjai City, the effectiveness value of WWTP is not efficient because the COD content in inlet wastewater shows results below the quality standards that have been set.
3. The effectiveness value of WWTP in the TSS parameter in March was 60%, April 32.25%, and May 57.14%. The average TSS effectiveness score was 49.79%. The value of effectiveness in reducing TSS is quite effective in reducing TSS. This is due to the presence of precipitation in the initial settling basin. The initial settling bath serves to precipitate or remove suspended solids.

CONCLUSION

1. Based on research, the Djoelham Regional General Hospital Wastewater Treatment Plant uses two methods, namely aerobic and anaerobic methods.
2. The results of tests conducted at the inlet bank of the Wastewater Treatment Plant of Djoelham Regional General Hospital Binjai City showed that the BOD and COD parameters met quality standards. TSS parameters have values above the quality standard, namely in April 31 mg / l and May 35 mg / l.
3. Test results from the outlet bank of the Wastewater Treatment Plant of Djoelham Regional General Hospital Binjai City show the value of the content of BOD, COD, TSS, and pH parameters that meet the quality standard values of the Minister of Environment Regulation Number 5 of 2014.
4. The performance effectiveness value of the Wastewater Treatment Plant of Djoelham Regional General Hospital Binjai City showed an average from March to May on the BOD parameter of 13.53% or inefficient, COD parameter of 3.57%, or inefficient, TSS parameter of 49.8% or quite efficient.

Suggestion

1. Share the Djoelham Regional General Hospital Binjai City Institute

More maximizing in monitoring Wastewater Treatment Plants, namely in checking the quality of inlet and outlet wastewater which is carried out for at least one month at least by the Regulation of the Minister of Environment Number 5 of 2014.
REFERENCES


