

# Performance evaluation of wastewater treatment plants in Taman's public health center in Sidoarjo District



Muslikha Nourma Rhomadhoni<sup>1\*</sup>, Achmad Syafiuiddin<sup>2</sup>,  
Nabila Febrianti<sup>2</sup>, Rizka Novembrianto<sup>3</sup>

## ABSTRACT

**Introduction:** In general, wastewater produced by Public health centers contains many microorganisms, pathogenic compounds, and hazardous and toxic chemicals that can cause environmental pollution and transmit various diseases.<sup>1</sup> The danger posed by the liquid waste produced is quite large, so it is necessary to have a wastewater treatment process before it is disposed of. Wastewater treatment is carried out using a wastewater treatment plant (WWTP). Thus, this study aims to evaluate the performance, environment and economy of WWTPs in Public health centers.

**Methods:** This research uses descriptive quantitative research methods. The inclusion criteria were the laboratory data results in 2018 and 2019. The exclusion criteria were the data needed to be completed. The research variable was the performance of the WWTP on wastewater quality. The data analysis of the laboratory test results is analyzed and compared with the East Java Governor Regulation Number 72 of 2013 concerning Wastewater Quality Standards for Business and Hospital Activities.

**Results:** The results of laboratory tests in 2018 showed the parameters by the requirements according to regulations, such as temperature, pH, BOD5, COD and TSS. At the same time, the parameters were not following requirements according to rules such as free NH<sub>3</sub>-N, PO<sub>4</sub> and MPN-coliform bacteria. Data from laboratory test results in 2019 showed requirements according to regulations: temperature, pH, BOD5, and TSS. The effects on the COD parameter were seen only in July that they did not follow the requirements, while most of the results for the NH<sub>3</sub>-N, PO<sub>4</sub> and MPN-free coli groups did not meet the criteria.

**Conclusion:** Based on the research done in this study, the following conclusions can be drawn: The results of the performance evaluation of the WWTP at the Taman Public health center are included in the category that meets the stipulated regulatory requirements.

**Keywords:** Wastewater treatment plants, performance, public health center, liquid water.

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<sup>1</sup>Department of Occupational Safety and Health, Faculty of Health, Universitas Nahdlatul Ulama Surabaya-60237, East Java, Indonesia;

<sup>2</sup>Department of Public Health, Faculty of Health, Universitas Nahdlatul Ulama Surabaya-60237, East Java, Indonesia;

<sup>3</sup>Departement of Environmental Engineering, UPN Veteran Jawa Timur, Surabaya, 60237-East Java, Indonesia.

\*Corresponding author:

Muslikha Nourma Rhomadhoni;  
Department of Occupational Safety and Health, Faculty of Health, Universitas Nahdlatul Ulama Surabaya-60237, East Java, Indonesia;

[muslikhanourma@unusa.ac.id](mailto:muslikhanourma@unusa.ac.id)

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## INTRODUCTION

In general, wastewater produced by Public health centers contains many microorganisms, pathogenic compounds, and hazardous and toxic chemicals that can cause environmental pollution and transmit various diseases.<sup>1</sup> The danger posed by the liquid waste produced is quite large, so it is necessary to have a wastewater treatment process before it is disposed of. Wastewater treatment is carried out using a wastewater treatment plant (WWTP). A wastewater treatment plant is a facility where various processes (e.g., physical, chemical and biological) are used to treat industrial wastewater and remove pollutants.<sup>2</sup> The wastewater from the Taman Sidoarjo Public health center uses a WWTP Biofilter using the Biological

System method through a combination of anaerobic and aerobic processes.

WWTP is very influential for the Public health center because WWTP is expected to minimize the dangers caused and make the quality of wastewater according to the expected standards. Wastewater quality that is not by quality standards results in decreased dissolved oxygen levels in wastewater. Therefore there is a need for an evaluation of the management of the WWTP of the Public health center.<sup>3</sup> The WWTP must be maintained and managed properly so that the WWTP can function and operate optimally. And must pay attention to maintenance, supervision and security risks to the processing installation.

In the process of running the WWTP, it is necessary to have supporting sources.

One of them is the source of electricity usage. The electricity consumption in the WWTP every 5 hours can reach 2,800 watts. This figure shows a large number considering that the WWTP works daily. The electricity used can produce CO<sub>2</sub> emission gas. CO<sub>2</sub> emission gases from electrical energy sources can cause air pollution.<sup>4</sup>

The operation of a WWTP requires costs in running a WWTP, including maintenance costs, procedures, repairs, and many others. Wastewater management is expensive and poses problems regarding how to finance it and how to reduce treatment costs. Adequate wastewater management is necessary to fund the investment in wastewater treatment plants (WWTPs) and treatment technologies'

costs and improve the environmental quality of water resources.<sup>5</sup>

Due to the importance of the role of WWTP, which many people still do not understand, thus without any treatment process from the WWTP system, the wastewater produced still contains hazardous substances and the free disposal of the wastewater without any prior treatment is then discharged into water bodies or infiltration. It can be harmful to humans and can pollute the surrounding environment. This study aims to evaluate the performance, environment and economy of WWTPs in Public health centers.

## METHODS

This research uses descriptive quantitative research methods. The population of this research is wastewater generated from the results of all activities of the Taman Sidoarjo Public health center and activities from the Waste Water Treatment Plant (WWTP) of the Taman Public health center environmental aspects of electricity consumption that have been converted and economic aspects of long-term costs incurred for WWTP operation. The inclusion criteria were the laboratory data results in 2018 and 2019. The exclusion criteria were the data needed to be completed.

The research variable was the performance of the WWTP on wastewater quality. The data analysis of the laboratory test results is analyzed and compared with the East Java Governor Regulation Number 72 of 2013 concerning Wastewater Quality Standards for Business and Hospital Activities.

## RESULT

Data from laboratory test results in 2018 and 2019 show parameters by the requirements of East Java Governor Regulation Number 72 of 2013 concerning Wastewater Quality Standards for Hospital Business and Activities. And the rest was not.

The results of laboratory tests in 2018 showed the parameters by the requirements according to regulations, such as temperature, pH, BOD5, COD and TSS. At the same time, the parameters were

**Table 1. Laboratory test results in 2018 and 2019 of WWTP**

| Laboratory Test Results In 2018  | Laboratory Test Results In 2019  |
|--|--|
| <ul style="list-style-type: none"> <li>• In Accordance Parameters               <ol style="list-style-type: none"> <li>1. Temperature</li> <li>2. pH</li> <li>3. BOD5</li> <li>4. COD</li> <li>5. TSS</li> </ol> </li> <li>• Not In Accordance Parameters               <ol style="list-style-type: none"> <li>1. free NH3-N</li> <li>2. PO4</li> <li>3. MPN-coli form bacteria</li> </ol> </li> </ul> | <ul style="list-style-type: none"> <li>• In Accordance Parameters               <ol style="list-style-type: none"> <li>1. Temperature</li> <li>2. pH</li> <li>3. BOD5</li> <li>4. TSS</li> </ol> </li> <li>• Not In Accordance Parameters               <ol style="list-style-type: none"> <li>1. NH3-N</li> <li>2. PO4</li> <li>3. MPN-free coli groups</li> <li>4. COD*</li> </ol> </li> </ul> |

\*Only detected in accordance in July only

not following requirements according to rules such as free NH3-N, PO4 and MPN-coli form bacteria.

Data from laboratory test results in 2019 showed requirements according to regulations: temperature, pH, BOD5, and TSS. The effects on the COD parameter were seen only in July that they did not follow the requirements, while most of the results for the NH3-N, PO4 and MPN-free coli groups did not meet the criteria.

According to Table 1, we can conclude that the parameters that were not in accordance in 2018 and 2019 were similar. Meanwhile, in 2019, the COD parameter was detected in accordance only in July.

## DISCUSSION

The results of the temperature parameter have met the requirements by staying within the stipulated regulatory quality standard limits. The values for temperature parameters ranged from 28°C to 29°C. The value at temperature is supported in the wastewater treatment process. It affects the sustainability of the decomposition process by microorganisms. Generally, the temperature in the anaerobic process is more sensitive, with a value of 25-35°C.<sup>6</sup> Another parameter was pH. The pH parameters have met the requirements by keeping within the standard quality limits. While the lowest value for the pH parameter with a value of 6.0 in February 2018, and the highest value in May 2019 with a value of 7.2. High pH, if not handled properly, can cause environmental pollution, odor, and turbidity.<sup>7</sup>

Biochemical oxygen demand (BOD) refers to the amount of dissolved oxygen needed by microbes to break down organic

material present in a given water sample at a certain temperature over a specific period. BOD is measured in a water sample during 5 days of incubation at 20°C, known as BOD<sub>5</sub>. In the BOD<sub>5</sub> parameter, the results have met the requirements by staying within the stipulated regulatory quality standards. The findings of previous research by Bayu et al. showed that the effects of the BOD parameters had met the established quality standards. However, these results cannot be concluded that these parameters do not contain hazardous toxic materials.<sup>8</sup>

The other parameter was COD. The COD parameter results for 2018 have met the regulatory requirements that have been set, while in 2019, there were results that exceeded the standard quality limit, namely in July. Previous research findings showed that the effects of the COD parameters did not meet the requirements or exceeded the normal quality limits.<sup>9</sup> The high value of COD in this study was due to high levels of pollutants by chemicals in unnatural and dangerous amounts.

The resulting TSS parameter has met the requirements by not exceeding the stipulated regulatory quality standards, with values ranging from 8-20 mg/l. The TSS results show that the TSS parameters are not dangerous or toxic. Conversely, if the TSS value is high, it will increase water scarcity. TSS of a water or wastewater sample is calculated by passing a precisely measured volume of water (typically one liter, but less if the particulate density is high, or as much as two or three liters for very clean water) through a pre-weighed filter with a designated pore size, then weighing the filter once more following the

drying process that removes all water on the filter. Glass fibers are frequently used to make filters for TSS measurements.<sup>10</sup>

Most of the free NH<sub>3</sub>-N parameters resulted in many that needed to meet the stipulated regulatory requirements. The highest value was 9.925 mg/l in February 2018. The findings of previous studies by Erna et al. and the research of Mulyati & Marhadi showed that the results of the NH<sub>3</sub>-N parameter still exceeded the standard quality limits according to established regulations. The high NH<sub>3</sub> value is caused because, in the processing, there is a problem; namely, in tank 3, the blower machine is dead. High NH<sub>3</sub>-N values can also be caused by the results of human waste, such as urine and feces, that are too much in the relevant agencies.<sup>11</sup>

Removing biogenic phosphorus compounds that may be eliminated using precipitation techniques has attracted more attention throughout the wastewater treatment process. Some of these methods include electrocoagulation, metal dissolving, and conventional chemical precipitation techniques.<sup>12</sup> The PO<sub>4</sub> parameter, the majority of the results, are still many who still need to meet the stipulated regulatory requirements. The lowest value was 0.005 mg/l in May 2019, and the highest was 9.038 mg/l in March 2019. The PO<sub>4</sub> value is influenced by activities originating from the laundry unit. The PO<sub>4</sub> value has a high-quality standard in this study due to using detergent or detergent foam.

The MPN-Germ parameter shows that most results must meet the stipulated regulatory requirements. However, there was a decline at the end of 2019. The highest value reached >1,600,000 MPN/100ml. Previous findings showed that the results of the MPN-coliform bacteria parameter still exceeded the quality standard. The high coliform value is caused by a chlorination or disinfectant bath that does not function optimally.<sup>11</sup>

Based on all the results, the parameters that do not meet the requirements are Free NH<sub>3</sub>-N, PO<sub>4</sub>, and MPN-coli bacteria. It can be concluded that the performance of the WWTP at the Taman Public health center is included in the category that meets the stipulated regulatory requirements. According to Rhomadhoni

& Ayu, in their research, it is stated that in managing liquid waste, it is necessary to have related management support such as human resources, materials, methods, and budgets. In the research of Rhomadhoni, MN, it is stated that to determine the performance of the WWTP, it is necessary to calculate the efficiency of the WWTP. It can be done by conducting a laboratory test of the WWTP inlet and outlet.<sup>13</sup>

The limitation of this research was that the study only uses secondary data and has yet to check through interviews. Based on the research that has been done, we suggest that the Taman Sidoarjo Public health center continue to improve the quality of the liquid waste effluent to obtain appropriate wastewater results.

## CONCLUSION

Based on the research done in this study, the following conclusions can be drawn: The results of the performance evaluation of the WWTP at the Taman Public health center are included in the category that meets the stipulated regulatory requirements. To produce optimal quality liquid waste effluent, it is necessary to have full management support from the Taman Public health center, such as human resources, materials, methods, and budgets.

## DISCLOSURE

### Ethical Clearance

Our institution has approved this study.

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### Conflict of Interest

None.

### Author Contribution

All of the authors contributed to this research

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