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ORGANIC WASTEWATER-GREY WATER MANAGEMENT IN THE RESIDENTIAL AREA

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ABSTRACT:
Organic Matter quality of Grey Water in the residential area near Kali Gisik Cemandi river is COD (Chemical Oxygen Demand) 146 – 516 mg / L and BOD (Biological Oxygen Demand) 76 – 280 mg / L. While Gisik Cemandi River is included in Class III rivers with COD values of 22 – 31 Mg / L. The quality of Kali Gisik Cemandi need to be maintained so not to drop down to river class. This method can be done by managing Grey Water from residential areas so that the effluent exits Gisik Cemandi River has BOD and COD value is comply with regulations. The management needed is technical, institutional, and financial. Technical management planning is carried out by providing recommendations so that residential area has management activities in the form of maintenance and repair by adjusting the existing facilities and infrastructure. In addition, a Wastewater Treatment Plant is needed to reduce concentration value of BOD and COD as indicators of organic pollutants. The high of BOD and COD will reduce river water quality because it reduces oxygen levels in water bodies to degrade organic matter. BOD/COD ratio of Residential Grey Water is 0.528 or biodegradable. Grey Water treatment for biodegradable ratio of wastewater can be planned with Biological Process. In carrying out technical management, it is necessary to have institutional management as a monitoring role between implementers and citizens. The recommendation of institutional management is to be able to follow the institutional practical guidance of the Ministry of Public Works. All technical and institutional management activities require financial management as capital in every implementation of Grey Water organic wastewater management in residential areas. Financial management calculations must be adjusted to regional regulations and calculated for the next few years by considering the value of inflation, so current financial planning can be used several years into the future.

Keywords: Grey Water, COD BOD Ratio, Residential Area, Management

INTRODUCTION

Grey Water is wastewater originating from domestic activities sourced from kitchens, laundry, sinks, and bathrooms (Abdalla et al., 2021; Patil et al., 2022). Grey Water contains

ingredients from shampoo, soap, toothpaste, food waste, oil, detergent, and so on (Dhiman et al., 2022; Perumpully et al., 2023). The combination of organic matter in grey water can be calculated using BOD and COD parameters (Patel et al., 2020). The results showed that domestic liquid waste (Grey Water) had BOD levels ranging from 134.9 mg / L – 197.32 mg / L; COD 320.54 mg/L – 360.78 mg/L (Natsir et al., 2021). There are three zones in the BOD/COD ratio, namely (Abdul Maulud et al., 2021). levels are toxic, biodegradable, and stable, based on the characteristic effects of the ratio (Khilji et al., 2022; Shaikh et al., 2021). Toxic if the BOD/COD ratio is below 0.1 and the BOD and COD values are more than 500 mg/L, biodegradable if the BOD/COD ratio is in the range of 0.1-1.0 mg/L, and stable if the BOD/COD ratio is below 0.1 and the BOD and COD values are less than 100 mg/L (Mangkoedihardjo, 2023; Tsakiris et al., 2021).

The quality of grey water, especially organic matter, will affect nearby water bodies (Gorgich et al., 2020). So, there is a need for directed and practical management carried out by residential area in managing Grey Water wastewater in participating in maintaining the quality of nearby water bodies (Boano et al., 2020; Dwumfour-Asare et al., 2020; Roshan & Kumar, 2020). The average residential or residential area does not yet have a Grey Water treatment plant and even Grey Water wastewater management has not been a major concern (Zamir, 2017). Residential wastewater management is needed to regulate all aspects of residential organic wastewater management (Schellenberg et al., 2020). This aspect is in the form of technical management. Institutional management and financial management are needed as a reference in determining the special levy for wastewater management of Grey Water Residential area

This study will discuss recommendations of technical management, institutional management, and financial management in managing Grey Water wastewater from residential area. Technical management recommendations will refer to regulation in Indonesia. The research area was conducted in one of the residential area estates near Kali Gisik Cemandi, Sidoarjo.

RESEARCH METHODS

The research method was preceded by monitoring the quality of BOD and COD Grey Water Residential area and Kali Gisik Cemandi. Grey Water sampling in Residential area is taken in the last channel before entering the collection Bozem (Van de Walle et al., 2023). While the Kali Gisik Cemandi sample was sampled at two points, namely point 1 was before the flow of Residential Grey Water and Point 2 was taken after the flow of Grey Water from Residential area. After obtaining the results, conduct an interview with the developer to find out the technical, institutional, and financial management in existing conditions. Then provide recommendations for technical, institutional, and financial management for Residential area.

BOD and COD sampling in Residential area and Gisik Cemandi River was conducted on dry season to avoid mixing with rainwater to to represent actual conditions. After obtaining the results of BOD and COD, conducted an unstructured interview with the developer to find out the technical, institutional, and financial management in existing conditions. Unstructured interview is an interview technique without using systematically structured guidelines. The guidelines used are only an outline of the problem so that the interviewer does not know for sure about the data obtained and tends to listen to the respondent's story. After all data is collected, then the problem will be analyzed. The result is provided recommendations for technical, institutional, and financial management for Residential area.

RESULTS AND DISCUSSION

Identification organic matter quality of Grey Water in Residential Area.

The results showed that Grey Water residential area has BOD and COD values above the required government quality standards. Based on the Regulation of the Ministry of Environment and Forestry Number P68 of 2016, the quality standard for domestic wastewater that can be released into the environment for BOD is a maximum of 30 mg / L, while COD is a maximum of 100 Mg / L. The following are the results of monitoring residential Grey Water.

Table 1. BOD and COD Residential Grey Water Sampling Result

No.	Date	COD (Mg/L)	BOD (Mg/L)	Ratio BOD/COD
1	August 18, 2023	350	180	0.514
2	August 21, 2023	316	164	0.519
3	August 23, 2023	146	76	0.521
4	August 25, 2023	516	280	0.543
5	August 28, 2023	506	276	0.545
6	August 30, 2023	189	90	0.476
7	September 01, 2023	202	105	0.520
8	September 04, 2023	332	176	0.530
9	September 06, 2023	158	84	0.532
10	September 08, 2023	151	80	0.530
11	September 11, 2023	300	160	0.533
12	September 13, 2023	160	84	0.525

Based on the data above, it shows that fluctuations in BOD and COD as indicators of organic pollutants in Grey Water in residential areas are in the range of COD values of 146 – 516

Mg / L while BOD values are in the range of 76 – 280 Mg / L. Fluctuations in BOD and COD values are affected by household activities that produce Grey Water. The ratio value of BOD and COD shows that Grey Water is biodegradable or biologically treatable (Rakesh et al., 2020).

Identification organic matter quality at Kali Gisik Cemandi River.

The results of COD monitoring in Gisik Cemandi River will be referred based on Government Regulation of the Republic of Indonesia Number 22 of 2021 Annex VI concerning river water quality standards. In general, COD is included in class III of river quality. Class 3 of river quality based on the regulation is used for water feed whose designation can be used for freshwater fish farming, animal husbandry, water to irrigate crops, and/or other designations that require the same water quality as that use. Here are the details of the COD values of Kali Gisik Cemandi water body.

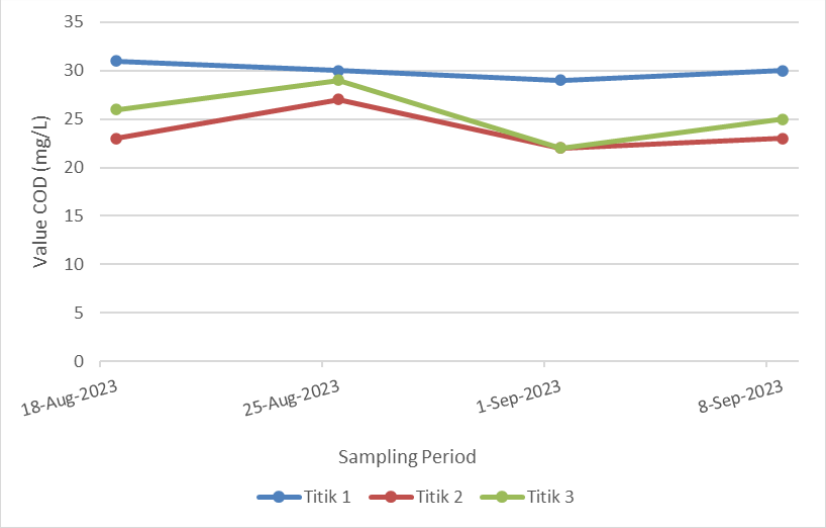

Figure 1. Concentration COD Sampling Results

Based on the data above, it shows that fluctuations in COD as indicators of organic pollutants in Kali Gisik Cemandi as the nearest residential water body. COD in the range of 22-31 Mg/L.

Existing Conditions at Residential

Based on the results of surveys and interviews, in the residential area there is no wastewater treatment. Grey Water is only flowed into Bozem and if there is rain it will mix with rainwater. Technical management is carried out only by performing cleaning in the channel and inside the Bozem. In addition, if there is damage only. Technical, institutional, and financial management for grey water management has not yet been planned. Thus, there needs to be recommended guidelines so that Grey Water organic wastewater management can run in Residential Areas.

Technical Management Recommendation for Grey Water Management.

Technical recommendations for the implementation of organic wastewater management (Grey Water) looking at the current existing conditions carried out are in the Table 2 below, but this is not completed, because it needs Grey Water treatment so that before being discharged into water bodies it can meet the required quality standards.

Table 2. Recommendation for Technical Management on Existing Facilities.

Description	Activity	Frequency
Repair	Bozem Repair	1 time per year
	Grey Water/Drainage Channel Repair	1 time per year
Maintenance	Garbage cleaning in Bozem	2-5 times per month
	Sludge Bozem cleaning	2 times per year
	Grey water/drainage cleaning	3 times per year

Wastewater treatment plants need to be planned as a means of treating Grey Water so that the treatment results can meet the required quality standards. An example of wastewater treatment that can be used is utilizing water plants placed in Bozem to reduce the content of organic pollutants in Grey Water. So that the residential area can participate in maintaining the water quality of Kali Gisik Cemandi does not decrease in the quality of its water bodies.

Here are some recommendations for aquatic plants that can be used to reduce BOD and COD.

Table 3. Recommendation Aquatic Plants for Grey Water Treatment.

No.	Aquatic Plants	Removal Organic Matter of Domestic Wastewater (%)	
		BOD	COD
1	***Vetiveria zizaniodes*** Reference: Kurniawan, et al., 2020	**92,96%**	**52,56%**
2	***Typha orientalis*** Reference: Borkar, et al., 2011	**86%**	**63%**
3	***Salvinia natans***	**96.90%**	**95%**

	Reference*:* Laabassi, et al., 2019	
4	***Pistia stratiotes*** Reference*:* Lu, et al., 2018	**61.70%**
5	***Eichhornia crassipes*** Reference*:* Kutty, et al., 2009	**49%**

Plant number 1 is used in previous research for Domestic WWTP outlets. Plant number 2 is the previous research for municipal wastewater. Plant number 3 is the previous research for raw domestic wastewater. Plant number 4 for polluted rivers. Plant number 5 for municipal wastewater. The use of plants above can be combined between plants or with other technologies.

Institutional Management Recommendation for Grey Water Management.

Recommendations for institutional management in residential areas can follow the practical guidelines for Institutional Arrangement of Wastewater Management System Operators by the Public Works Office. The following are aspects that can be practiced in institutional management in residential areas in organizing Grey Water wastewater management.

Figure 2. Institutional Management Aspect

Financial Management Recommendation for Grey Water Management.

According to Prisanto, 2015 financial and institutional aspects are aspects that require more serious attention because they are related to the community or stakeholders (Straub et al., 2020). Financial management for Grey Water organic wastewater management activities can be practiced in the following ways: Record all field work to be carried out, Create detailed cost budgets for all activities, tools, and materials, The details of the cost budget must be adjusted to the actual price and refer to related regulations, After obtaining the total cost, it is appropriate to calculate the increase in costs over the next few years referring to existing inflation.

CONCLUSION

The quality of water body of Kali Gisik Cemandi, Sedati is at the quality of the Class III River for COD based on Government Regulation No. 22 of 2021 Annex VI. The value needs to be maintained so that it does not go down and as much as possible strive so that the quality improves. The way to treat it is to monitor the source of Greywater wastewater from residential areas. The results of monitoring the quality of organic matter represented by COD in residential Grey Water are 146-516 Mg / L. The value must be lowered in accordance with the required domestic wastewater quality standards to maintain the quality of the Kali Gisik Cemandi water body. Referring to this, Grey Water wastewater management is needed which plan technical, institutional, and financial management in the residential area around Kali Gisik Cemandi.

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