

Effectiveness of Using of Crype Plants (*Pistia stratiotes*) in Decreasing BOD Level of Surface Water in West Pagutan of Mataram City

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Abstract

One simple processing alternative that can be applied to reduce pollutant concentration with BOD parameters is to utilize Kiapu plant, where one of the variables that influence in the process of deterioration is detention time, media depth and certain speed. The purpose of this research is to know whether Kiapu Plant can decrease BOD level in Pagutan water. This research type is comparative research (comparison) by using quasi experiment research design. The sampling method is grab sampling Sampling was conducted July 2016 at Sewer water located in West Pagutan Village Mataram City, by taking the location of treatment at Lake Tondano street. Number. 20 in BTN Pagutan Permai. Result of research analyzed to use test of ANOVA. The results showed that the average BOD concentration in the use of kiapu 0% (without the use of kiapu crops was 3.28 mg/l, the mean BOD concentration on 50% kiapu plant was 2.82 mg/l, kiapu 100% is 2.26 mg/l, and from the results of statistical analysis obtained F count/ output > f table or (9.859 > 3.89) . Conclusion that the utilization of Kiapu Plants can reduce BOD levels in BTN Pagutan Permai waterway, and based on the result of the percentage decrease in BOD levels, the more the use of kiapu (100%) the more effective the BOD decrease this is because kiapu plant able to increase dissolved oxygen level and able to decompose organic material by kiapu plant, and based on result of percentage decrease of BOD most effective is use 100% kipau.

Keywords: Water sewer, Plant Kiapu, BOD level

I. INTRODUCTION

Water and its resources are one of nature's resources that is absolutely needed by living things to sustain its survival and maintain its health. The presence of water in this world is of utmost importance to the living because without water all will perish. So it can be said that water can not be separated with life, without water there can be no life. The development of science has proved how important the water in various phenomena. However, water resources are limited and if mismanagement can cause damage/destruction (flood and other disasters). Therefore, the development and management of water resources nationally is a must (Suyono, 1993).

Increasing population and growing economic growth, demand for water resources both in quality and quantity is increasingly more than its availability. This is further supported by the critical issue which states that the availability of clean water for the needs of the general population who live in urban areas both in terms of quality and quantity, more difficult to obtain.

The ditch in Pagutan is a small river whose water comes from Pesongoran River Pagutan Barat and flows along about 10 km to the Tanjung Karang Sea. Seeing Pagutan now with the old, of course many different, at least in terms of cleanliness of the surrounding area. But in terms of waste, Dune Shutters are now more dirty because now around the gutters have densely settlements that can dispose of various kinds of waste into gutters both domestic waste and industrial waste. In addition, there has also been a shift in people who are more likely to use bottled drinking water. Therefore, to restore public confidence in surface water it is necessary to do the processing before the surface water is used (Suparmin, 2000).

In this research, the raw water samples used are water samples taken from Pagutan water and water as a water sample that needs to be processed to improve its quality especially for BOD concentration. As one of the simplest processing alternatives that can be applied to reduce the pollutant concentration with BOD parameter is by utilizing Kiapu plant, where one of the variables that influence in the process of deterioration is detention time, media depth and certain speed.

II. METHODS

The type of research used was comparative research (comparison) that was the measurement of the variable to find the influence/difference to the treatment. The design of this research used the design of quasi experiments or time series design. Sampling method used in this research was grab sampling method, which was sampling of river water representing water situation in a place at certain time but the taking is not united. Sampling was conducted July 2016 at Sewer water located in West Pagutan Village Mataram City, by taking the location of

treatment at Lake Tondano street. Number. 20 in BTN Pagutan Permai. Samples were tested at the Mataram College of Environmental Engineering (STTL) laboratory. Result of research analyzed to use test of ANOVA.

III. RESULTS

A. Results of Early BOD Measurement

Sampling water samples of BTN Pagutan Permai before being given treatment with kiapu plant, samples taken directly to the laboratory were examined BOD initially. The initial sample is only done for 5 days. The results can be seen in table 1.

Table 1. Distribution of BOD Early Water Sewers BTN Pagutan Permai

Number	Days	Early BOD (mg/l)	Information
1	Wednesday, 13 Juli 2016	4.6	> Quality Standard Value
2	Thursday, 14 Juli 2016	3.7	> Quality Standard Value
3	Friday, 15 Juli 2016	3.4	> Quality Standard Value
4	Monday, 18 Juli 2016	4.1	> Quality Standard Value
5	Tuesday, 19 Juli 2016	3.2	> Quality Standard Value
Average		3,8	> Quality Standard Value

Based on the data in table 1 above, the initial BOD levels of BTN Pagutan Permai sewer water on first day was 4.6 mg/l (exceeds the Class II Water Quality Score), while on second day was 3.7 mg/l (exceeds the Class Water Quality Score II), while on thirth day was 3.4 mg/l (exceeds Class II Water Quality Score), whereas on fourth day was 4.1 mg/l (exceeds Class II Water Quality Score), while on fifth day was 3.2 mg/l (exceeds the Class II Water Quality Score) with an average BOD levels of 3.8 mg/l (exceeds the Class II Water Quality Score).

B. Results of Final BOD Measurement

Pagutan Permai water samples taken for 5 days were then given treatment for BOD concentration after treatment using Kiapu Plant in reactor with various density of plant. The samples treated using Kiapu Plant at the reactor with various density of the plant were then measured the final BOD levels. The results can be seen in table 2 below.

Table 2. Distribution of Final BOD Levels after Using Kiapu Plant at Reactor with Various Density of Plants

Days	Final BOD after Using Kiapu Plant		
	Kiapu 0% (mg/l)	Kiapu 50% (mg/l)	Kiapu 100% (mg/l)
1	4.1	3.2	2.6
2	3.0	2.8	2.2
3	2.9	2.4	2.0
4	3.4	3.0	2.4
5	3.0	2.7	2.1
Average	3.28	2.82	2.26

The average of the final BOD measurement after the use of Kiapu Plants with various types, among others, the average BOD levels in the use of 0% kiapu plant was 3.28 mg/l, the average BOD levels on the use of 50% kiapu plant was 2.82 mg/l, the mean BOD levels in 100% kiapu plant usage was 2.26 mg/l.

C. Decreasing and Percentage of Decrease of BOD Level

After knowing the final BOD levels with the use of Kiapu Plants with various types, it can be seen the decrease of BOD in each treatment with the formula (Alert and Santika):

$$\text{Decreasing of BOD} = \text{Early BOD} - \text{Final BOD}$$

While the percentage of BOD decreasing is known by the formula:

$$\text{Decrease Percentage of BOD} = \frac{\text{Early BOD} - \text{Final BOD}}{\text{Early BOD}} \times 100$$

Decreasing of BOD on Pagutan water after being treated by Kiapu Plant with various types (table 3).

Table 3. Decrease percentage of BOD in sewer water Pagutan after given treatment of Kiapu plant with various type

Days	Decrease Percentage of BOD in sewer water Pagutan after given treatment of Kiapu Plant					
	Kiapu 0% (mg/l)		Kiapu 50% (mg/l)		Kiapu 100% (mg/l)	
1	0.5	10.9	1.4	30.4	2.0	43.48
2	0.7	18.9	0.9	24.3	1.5	40.54
3	0.5	14.7	1.0	29.4	1.4	41.18
4	0.7	17.1	1.1	26.8	1.7	41.46
5	0.2	6.3	0.5	15.6	1.1	34.38
Average	0.52	13.6	0.98	25.4	1.54	40.2

From the data in Table 3 showed that the average of the final BOD measurement after the use of Kiapu Plant with various type, among others, the average decrease of BOD levels in the use of 0% kiapu plant is 0.52 mg/l (13.6%), the average decrease of BOD concentration in the use of 50% kiapu plant was 0.98 mg/l (25.4%), the average decrease of BOD levels in 100% kiapu use was 1.54 mg/l (40.2%).

III. DISCUSSION

A. Results of Early BOD Measurement

Based on the data in table 1 above, the initial BOD levels of BTN Pagutan Permai sewer water on first day was 4.6 mg/l (exceeds the Class II Water Quality Score), while on second day was 3.7 mg/l (exceeds the Class Water Quality Score II), while on thirth day was 3.4 mg/l (exceeds Class II Water Quality Score), whereas on fourth day was 4.1 mg/l (exceeds Class II Water Quality Score), while on fifth day was 3.2 mg / l (exceeds the Class II Water Quality Score) with an average BOD levels of 3.8 mg/l (exceeds the Class II Water Quality Score).

The use of research water as class II water based on Government Regulation no. 82 of 2001, because the intended water may be used for water recreation facilities, freshwater fish farming, livestock, water to irrigate crops and/or other designations that require the same water quality as those uses and where such water bodies have not been specified class the water then set the water into class II with the assumption score of -1 untill -10 with mild levels of mild polluted STORET method. (Decree of State Minister of Environment Number: 115 Year 2003 About Guidance of Determination of Water Quality Status).

The high BOD value of surface water is > 3 mg/l for BOD class II water standard in a water body because the water is contaminated by organic substances, bacteria can deplete dissolved oxygen in water during the oxidation process which can cause death of fish in water and may cause a foul odor to the water. Some organic or inorganic substances can be toxic such as cyanide, copper, etc., so it should be reduced to the desired extent (Ependi, 2003).

Reduced oxygen during biooxidation is actually in addition to being used for the oxidation of organic matter, also used in the process of cell synthesis and cell oxidation of microorganisms. Therefore, the BOD test cannot be used to measure the amount of organic materials actually present in water, but only measure the relative amount of oxygen consumption used to oxidize the organic material. The more oxygen consumed, the more organic ingredients it contains (Sukman, 1998).

B. Results of Final BOD Measurement

The average BOD levels in the use of 0% kiapu plant was 3.28 mg/l, the mean BOD concentration in the 50% kiapu plant was 2.82 mg/l, the mean BOD levels in 100% kiapu plant was 2.26 mg/l . This is because to be able to live the plant requires nutrients (nutrients) taken in the molecule through the leaves, but generally nutrients are taken by plants in the form of molecular ions from the water. The longer the roots of the plant, the more nutrients available to the plant, the greater the rooting system and the increase in root branching volume, will increase nutrient uptake. (Salim, 1999).

C. Decrease in BOD levels

The average result of the final BOD measurement after the use of Kiapu Plant with various variations among others, the average decrease of BOD levels in the use of 0% kiapu plant was 0.52 mg/l (13.6%), the average decrease in BOD levels on the use of plants 50% kiapu was 0.98 mg/l (25.4%), the average decrease in BOD concentration in 100% kiapu use was 1.54 mg/l (40.2%).

The decrease in BOD levels is due to the role of media of kiapu plant and the presence of organic materials in the reactor and the role of microorganisms. The process that occurs due to the media of the kiapu plant is caused by the leaves of the wilted plant and fall into the reactor and the death of the plant resulting in dissolved organic material in this case the plant utilizing kiapu for photosynthesis and nutrients by the plant. The role of microorganisms in this reactor is to decompose organic particles in surface water as nutrients for plant growth (Hasan, 2004).

With the increasing number of dead leaves and fall into the reactor column, the addition of organic matter also increases the concentration of BOD. Rapid algae growth occurs due to the fulfillment of the needs in the growth of sunlight, nutrients and oxygen, with the highest growth during high and warm temperatures (Mahida, 1994).

Algae and bacteria are in freshwater and salt water naturally. Reed, 1987 also suggests that algae can grow when enough nutrients and sunlight are available for the algae assimilation process. Algae and bacteria that grow rapidly is one factor that can lead to an increase in organic matter. This is due to the life cycle and death of algae, bacteria, and dead carcasses and fall into the water. If algae, bacteria and leaves and stems of plants die in the water will cause the amount of organic carbon increases in the reactor.

D. Decrease Analysis of BOD Levels

The data of BOD levels before and BOD data after after Kiapu Plant Use with various variations were obtained, then the data were analyzed to find out whether the utilization of Kiapu Plant could decrease BOD levels in BTN Pagutan Permai water, so that the hypothesis in this research can be answered. For analysis done with ANOVA statistic according to technique of data analysis at previous CHAPTER. As for the result as follows:

The result of F arithmetic is obtained from computer analysis by entering the BOD value of each variation of kiapu crop, after which it is analyzed by the steps that have been determined the significant level (α) is 5%, Numerator is (number of variation of kiapu-1) or (3-1) = 2, Denominator is the number of samples - the number of variations of the kiapu plant) or (15-3) = 12, and then obtained 3.89.

Output is obtained then read the value of F arithmetic = 9.859 with probability value above 0.003 = 0 read in the output analysis is the value of Sig. Therefore F count / output > f table or (9.859 > 3.89), then the statistical hypothesis is accepted and it can be concluded that the utilization of Kiapu Plant can decrease BOD levels in BTN Pagutan Permai water.

Hypothesis is accepted so that utilization of Kiapu Plant can decrease BOD levels in BTN Pagutan Permai water. Based on the percentage of decrease in BOD levels, the more use of kipau (100%), the more effective BOD decrease this is because kiapu plants can increase dissolved oxygen levels and able to decompose organic materials by kiapu plants.

When viewed from the results of laboratory tests, the most effective use of kiapu crops is 100% of kiapu use because it is able to reduce BOD with BOD levels is 1.54 (40.1%) mg, and this is in accordance with the regulation based on Government Regulation No. 82 year 2001 on Water Quality Management and Water Pollution Control with Quality Score of Class II Water Quality that is BOD = 2.0 mg/l.

IV. CONCLUSION

The average BOD levels in the use of kiapu 0% (without the use of kiapu plants is 3.28 mg/l), The average BOD concentration in the 50% crops use was 2.82 mg/l, and The average BOD levels in 100% kiapu plant use was 2.26 mg/l.

From the result of statistical analysis obtained F count/output > f table or (9.859 > 3.89), then the statistical hypothesis is accepted and it can be concluded that the utilization of Kiapu Plant can decrease BOD levels in BTN Pagutan Permai waterway, and based on the percentage of decrease in BOD the most effective is the use of 100% kiapu.

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