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Method for the Determination of BOD and Validity of BOD Test in Water

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ABSTRACT

Aeration is an effort to improve dissolved oxygen when oxygen is in critical condition in water body. Ir . H. Djuanda Reservoir is utilized for fish farming activities by floating net cage culture impact on water quality, among others, an increasing of organic matter from the rest of wasted feed and fish feces and decreased oxygen waters. Increasing the organic matter will cause pollution if not balanced with sufficient oxygen to decompose the organic matter. The purpose of this study to determine the rate of BOD (*k*) in the treatment of water pre and post aerated for 8 hours. The study was conducted in floating net cage culture locations with aeration at a depth of 3.6 m (depth of hypoxia) with system pumps air through compressor with pressure about 3 atm for 8 hours . Sample was conducted in June - September 2013 and BOD subsequently measured daily for 7 days. *k* values was calculated by Least Square method. The results showed that the BOD_5 was higher in pre- aeration (4.57 -8.74 mg/l) than post aeration (3.52 to 8.13 mg/l). The rate of BOD was higher post- aeration (0.2461 to 0.3335 per day) compared to pre- aeration (from 0.1262 to 0.2776 per day). This was caused post aeration oxygen supply gets larger than pre aeration so as to decompose organic matter.

***Keywords*—** aeration, *k* value, BOD, Ir. H. Djuanda Reservoir

I. INTRODUCTION

Aeration is an effort to increase the dissolved oxygen that can be carried out during the critical dissolved oxygen conditions in order to prevent the occurrence of fish mortality (Qoyyum et al., 2005). Endo et al. (2008) states that if the low-oxygen conditions can affect the activity feed, feed conversion, growth and health of farmed fish. Oxygen is a key factor for aquatic life to respiration process. Oxygen is also used for the decomposition of organic matter that can produce compounds that are not harmful to aquatic biota.

The content of organic matter in an amount sufficient to fertilize the waters, but if the more can pollute waters so can decreased dissolved oxygen levels, rising CO_2 levels and turbidity (Cahyono, 2001). One source of organic matter in Ir. H. Djuanda reservoir is a waste of fish farming activities in floating net cage which may from residual undigested feed, fish feces and urine . The number of cages in the reservoir has increased from year to year and by 2010 had reached 19 630 unit whereas by SK Bupati Purwakarta No. 06 Year 2000, the optimum floating net cage are 2100. This means that the number of unit have over nine times more than the permitted capacity. An increase in organic matter can cause a decreasing of dissolved oxygen because oxygen will be used to the decomposition process of organic matter.

Increasing of organic matter needs to be balanced with sufficient oxygen production. Organic matter in the waters will be decomposed by microbes and requires oxygen. Continuously of oxygen usage for oxidation process leads decreasing of oxygen in the waters. It is supply adequate of oxygen continuously. If the oxygen production is smaller than ~~e~~ oxygen consumption will cause oxygen deficit.

Biochemical Oxygen Demand (BOD) is the amount of oxygen required by microorganisms to decompose organic matter. BOD value is influenced by temperature, pH, incubation time, osmotic conditions, as well as the oxygen availability (Dhage et al., 2012). Value of *k* (rate of BOD) shows the magnitude of the rate of decomposition of organic matter by aerobic microorganisms in aquatic and the value *k* of aerobic conditions is 1/day (Astono et al., 2008; Harsono, 2010). Ultimate BOD is the total amount of oxygen consumed during the reaction (Dhage et al., 2012). The purpose of this study was to determine the value of k by pre and post aerated treatment for 8 hours in floating net cage water .

II. METHODOLOGY

The study was conducted at fish farmed by floating net cage in the reservoir Ir. H. Djuanda, West Java in June – August 2013. Aeration was done for 8 hours with air compressed system at ~~a~~ depth of 3.6 m which is the depth of hypoxia using compressor 2 HP and pressure of 3 atm. Water samples pre and post aeration was taken 3 liters in

depth 3,6 m. Then, sample put into dark bottles Winkler respectively of 8 samples to BOD analysis. One sample was analyzed as $DO_{0\ day}$ (DO initial) and seven bottles was incubated for 7 days as did Singh (2004) in an incubator with temperature as in the location of floating net cage. Observations DO (dissolved oxygen) with the Winkler method (APHA, 2005) carried out every day.

Determination of the rate of oxidation of organic matter (*k*) through the measurement of BOD every day. To measure the first BOD measuring initial DO (0 day) and then another sample and dark bottles were incubated and measured daily DO it. BOD value calculation is:
To determine the value of the rate of oxidation of organic matter (*k*) based on observations of daily BOD by Least Square method (Tchobanoglous et al., 2003; Singh, 2004), namely:

$$\mathbf{dL/dt = -kL_t}$$

where:

$L_t = L_0 - y_t$

$y_t = BOD_t$

$dy/dt = k(L_0-y_t)$

$dy/dt = kL_0 - ky_t$

Determination of *k* and L_0 based on linear equations that can be calculated:

$$\mathbf{S_{xx} = n\sum y_t^2 - (\sum y)^2}$$

$$\mathbf{S_{xy} = n\sum y_t(dy/dt) - (\sum y_t)(\sum dy/dt)}$$

Slope or $-k = S_{xy}/ S_{xx}$)

Intercept or $kL_0 = \sum(dy/dt)/n + k\sum(y_t)/n$

L_0 = Intercept / (-slope)

$$\mathbf{dy/dt = (y_{t+1} - y_{t-1})/2\Delta t}$$

where,

y_t : BOD values observed

y_0 : initial BOD or day 0 ~~of 0 mg/l~~

Δt : time interval of observation

t : observation days 1, 2,3, ...

L_0 : ultimate BOD (mg/l)

n : total number of observations

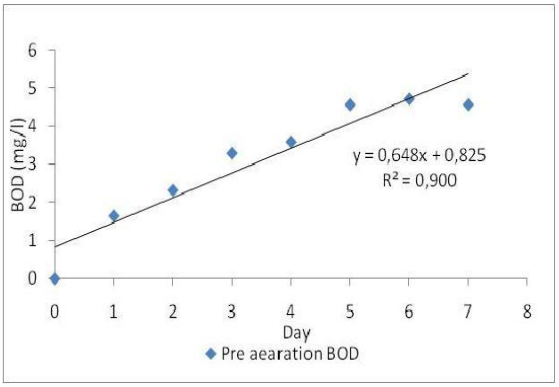
k : The rate of BOD (per day)

III. RESULTS

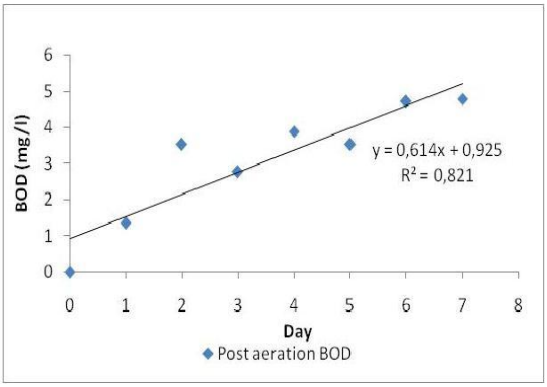
Temperature in depth 3,6 m in this research used incubation were 29.5; 29.5; 28.5 and 28.5 respectively. Changes of BOD pre and post aeration is presented in Figure 1.

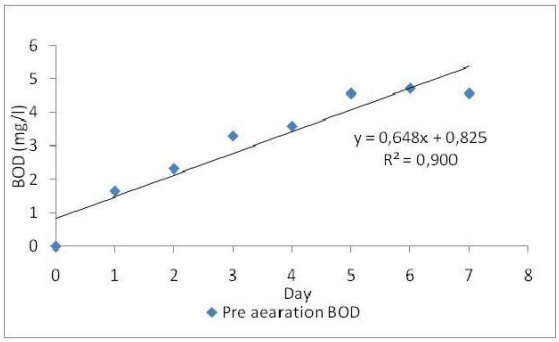
Figure 1. Changes in the amount of BOD during the 7 days of observation

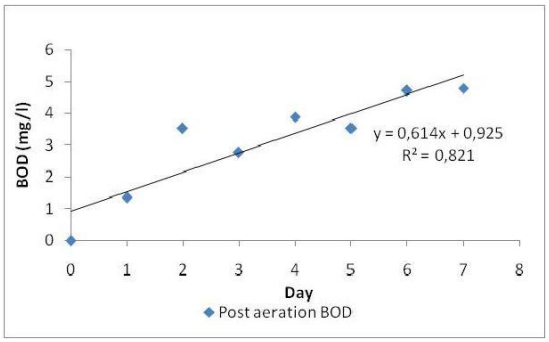
Pre aeration 1

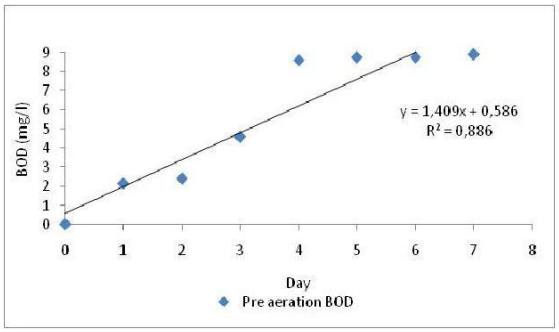


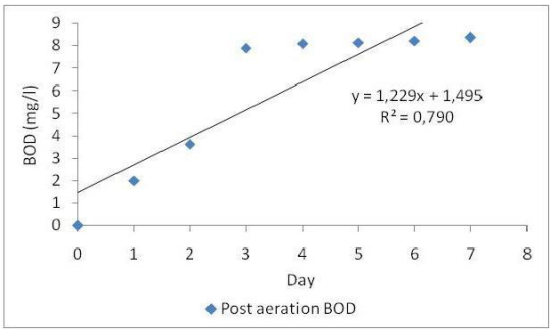
Post aeration 1











IV. CONCLUSION

Aeration is an effort to improve oxygen waters to be able the need of oxygen for the microorganisms in the decomposition of organic matter. Pre aerated BOD_5 is higher than post aeration. The rate of decomposition of organic matter (*k*) has been aerated water is higher than before aeration. That is through aeration can improve the adequacy of oxygen resulting in oxygen for the microorganisms to decompose organic matter

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