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E-Ox Level: Sustainability Test of Data Storage System and Performance Test on Closed System Fish Pond

Billi Rifa Kusumah[1*], Asep Kosta Jaya[2], Ridwan Siskandar[3], Fauzan Fathur Rahim[4]
[1,2,4] *Faculty of Marine and Fisheries Technology, Nahdlatul Ulama University Cirebon, Cirebon, Indonesia*
[*]*billirifa@gmail.com; asepkostajaya@gmail.com; m.fauzan.f@gmail.com*
[3]*Computer Engineering Study Program, College of Vocational Studies, IPB University, Bogor, Indonesia*
ridwansiskandar@apps.ipb.ac.id

Abstract

Billi Rifa Kusumah, Asep Kosta Jaya, Ridwan Siskandar, Fauzan Fathur Rahim. 2022. E-Ox Level: Sustainability Test of Data Storage System and Performance Test on Closed System Fish Pond. Fish farming using a closed system is very susceptible to death in a chain because it does not change the water so that the water quality decreases relatively quickly. To solve this problem, they generally use a circulation pump machine and an aerator machine to add oxygen levels, so that water quality remains stable. E-Ox Level is a research technology that has been tested and is able to work continuously. Its function is to monitor water quality and control the aerator machine's on and off activity based on timing and dissolved oxygen levels. The power source used by E-Ox Level is solar energy. So that this technology can save energy and is environmentally friendly, because it does not use PLN electricity. This research is an advanced stage process from the previous E-Ox Level technology design engineering. The purpose of this research is to observe the ability of E-Ox Level technology to display measurement data on the LCD screen and store water quality data continuously on the SD Card, as well as observe the effect of the activity of the aerator control system to produce a more optimum fish harvest. The method used in this research is the process of observing the performance of the E-Ox Level and comparing the results of the growth pattern in a pond with an E-Ox Level, a pond with a Standard Aerator, and a control pond. The working principle is to carry out design activities, then install the E-Ox Level in the Budidkdamber pond. The types of data observed were the suitability of the data displayed on the LCD screen with those stored in memory, the amount of data and the stability of the data stored on the SD Card, as well as data comparisons from catfish growth patterns in budikdamber ponds installed with E-Ox Level, Aerator Standard, and control pool (without aerator). From the results of observations, the data shown on the LCD screen with the complete stored on the SD Card from January 25 to April 8, 2021 is appropriate. The number of deaths and growth patterns of fish using E-Ox Level and AC Aerator is better and faster than control ponds. The advantage of the E-Ox Level over standard aerators is that it uses solar energy as a power source..

Keywords: E-Ox Level; Save energy; Closed pool system; Data storage media, Fish quality improvement.

Introduction

During the pandemic season, the aquaculture business sector and its processing is one type of business that is being loved by the public and investors. The results of aquaculture commodities provide an additional supply of food needs for individuals to the wider community (Komarawidjaja 2006). In addition, ornamental fish farming commodities are also experiencing an increase in demand. However, the impact of this pandemic has made people very careful when choosing the quality of all products consumed, including food products from fish (Minggawati and Saptono 2012).

The factor that most influences the quality of cultured fish is water quality. Parameters that are commonly monitored include temperature and pH of the water. The

optimum pool water temperature is in the range of 28 – 30 °C. The optimum pool water pH is in the range of 6.8 – 7.5. The solution is to adjust the design of the pool so that it is not exposed to rainwater, and to measure water quality regularly using measuring instruments. A simpler way is to use an aerator to stabilize dissolved oxygen levels and pH (Aghnia et al. 2016). Its function is to optimize the metabolic processes of the fish and the activity of bacteria to break down piles of organic compounds from the rest of the feed and feces. So, without taking these measurements, water quality will be maintained.

The design of appropriate technology is an alternative that is very helpful in solving problems. E-Ox Level is one of the technology developments that can help solve the problems of fish cultivator groups. E-Ox Level is a proven research engineering technology. The test results conclude that the activity control system is able to work according to the design algorithm, and the electrical system is able to support all tool activities. So it can work continuously (Kusumah et al 2020). Its function is to monitor water quality and control the on and off activity of the aerator machine continuously, it can be based on time settings, it can also be based on dissolved oxygen levels in pool water. The power source used by E-Ox Level is solar energy (Kusumah et al 2020; Hasan et al. 2015). So from a benefit perspective, this technology will not be an additional burden for the cultivator group to pay monthly electricity costs.

This research is an advanced stage process from the previous E-Ox Level technology design research. The purpose of this research is to observe the ability of E-Ox Level technology to display measurement data on the LCD screen and store water quality data continuously on the SD Card. (Sanjaya et al. 2017; Wahjono 2014), and observe the effect of the activity of the automatic aerator control system to produce a more optimum fish harvest. (Shiyang et al. 2013; Siskandar and Kusumah 2019).

Methodology

Research Materials and Objects

This research was conducted for three months in the Budikdamber pond. The fish object that will be observed is the growth of catfish farming. The main components needed in this research are as follows, first is E-Ox Level Technology which is the main object of research to see the success rate of research objectives (Figure 1). The second is a standard AC aerator machine as a comparison. The third is a set of closed system ponds as a test medium for observing fish growth.

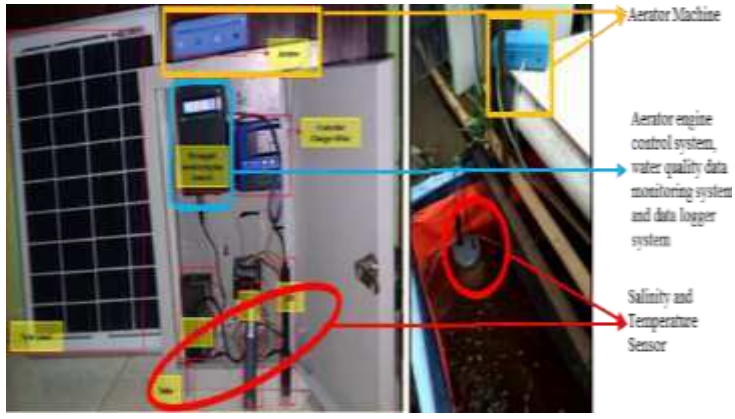

Figure 1. E-Ox Level (Kusumah et al 2020)

E-Ox Level is a technology that functions to monitor water quality and control aerator activity (Kusumah et al 2020). This technology is a development of standard aerator machines that are commercially available on the market. In one package of this technology there is a device for monitoring the temperature and pH of the water as well as a tool for controlling the aerator machine. This data can be integrated to regulate the work system of providing aeration in fish ponds so that water quality conditions always remain optimum. The working system of the aerator machine can be adjusted based on time or work continuously. Another plus is the source of electrical input required for E-Ox Level utilizing energy from the sun.

Procedure for testing the work function of E-Ox Level in the Budikdamber pond

Figure 2 shows the arrangement of the placement of three units of 80 L Budikdamber ponds. Each pond included 10 catfish per pond

with a length of ± 12 cm and a weight of ± 64.30 grams per fish. The observation process that will be carried out is the growth pattern of fish due to differences in aeration Pool I is installed with E-Ox-Level, pool II is installed with a standard aerator, while pool III is a control that does not use an engine. Other treatments such as the type of feeding and the change of pond water were ignored, because each pond was treated the same. The observation process in this pond was carried out for three months. The research observed in this test is to see the comparison of fish yields between ponds I, II and II and to observe the work function of the E-Ox Level tool

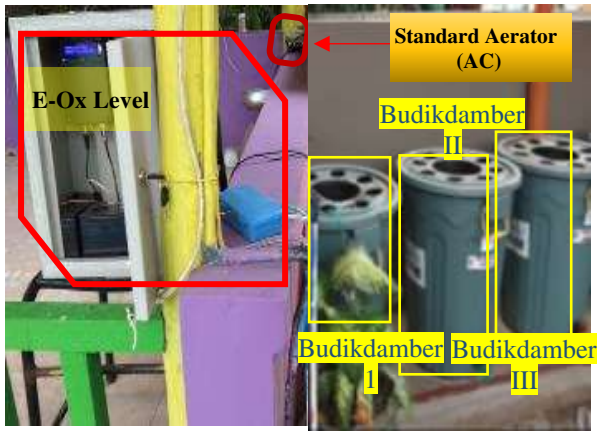

Figure 2. Systematic testing and installation of E-Ox Level in the Budikdamber pond

More precisely, this test was carried out for three months and fifteen days. The aim is to see the performance of the monitoring and data storage system, as well as to compare the growth of catfish between ponds I, II, and III. Table 1 describes in detail the test model information.

Table 1. Information on the treatment model for the cultivation of damber and fish distribution data

Pool Name	Number of Fish (head)	One Fish Stock Size		Weight of fish in one pond (g)	Treatment
		Long (cm)	Heavy (g)		
Pool I	10	± 12	± 64,30	626	E-Ox Level
Pool II	10	± 12	± 64, 30	630	Standard AC Aerator
Pool III	10	± 12	± 64, 30	627	Control (Without aerator)

Observation Methods and Data

The steps taken to analyze the work function of the E-Ox Level in this research are observing the display of water quality data information on the E-Ox Level LCD screen, seeing the presence of water quality data stored on the SD Card E-Ox Level per day, observing the suitability of the amount of data. and storage time of water quality data stored on the SD Card E-Ox Level per time interval, observing the comparison of fish growth patterns in ponds I, II and III in function tests in Budikdamber ponds.

Results

A. Test results of the sustainability function of the monitoring and data storage system

The data generated at this test stage is the observation data of water quality data that appears on the LCD and water quality data stored on the SD Card E-Ox Level. The following (Figure 4 is a display of water quality data on the E-Ox Level LCD.

Figure 4. Display of water quality data (water temperature and pH) on the LCD E-Ox Level

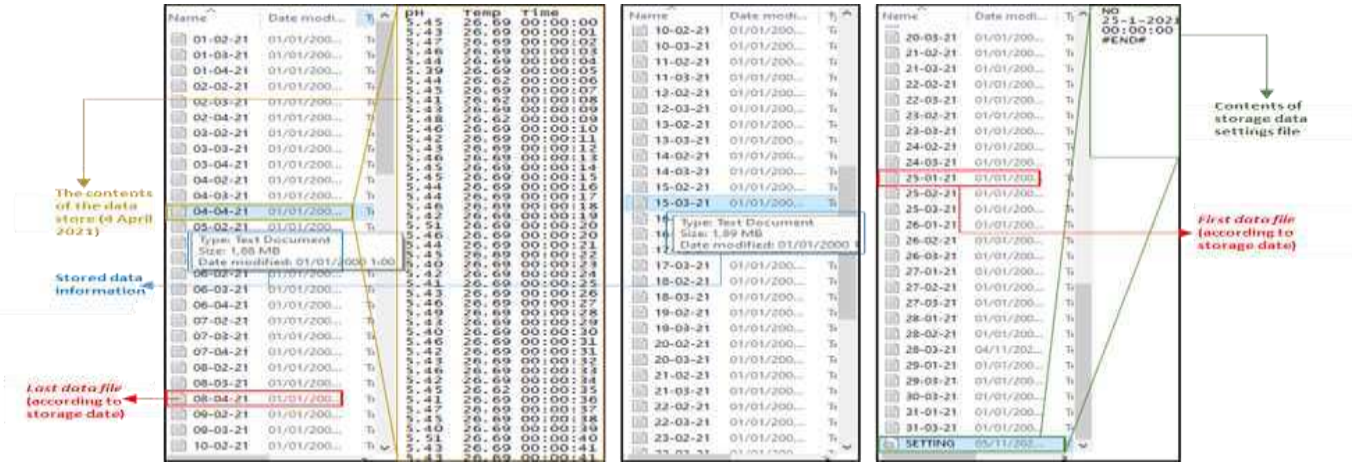

Figure 5. Display of data sheets stored daily on the SD Card
E-Ox Level

Figure 4 shows the display of water quality data that can be monitored in real time by the user. Data information that can be seen on the LCD is temperature and pH data. The data is measured by the system simultaneously according to the embedded time interval setting (in this study it is every one second), then displayed on the LCD continuously.

The results of the observation process for six months are known that occasionally the text and data characters on the LCD turn symbols into characters that cannot be understood. The results of the analysis, this happens when the power and data cables are touched, resulting in power instability which has an impact on the data transmission process. After restarting the system, the data display returns to normal.

The LCD light display will flash brightly and dimly when the battery power has reached the minimum threshold setting. Systemically, this is appropriate and deliberately designed to keep the power supply from reaching a minimum. when the system does not work due to very low battery power, the system will not work to display data on the LCD, also does not store data on the Sd Card, cannot even control the activity of the aerator. Usually, this LCD flashing problem occurs in the early hours of the morning ranging from 01.00 to 06.00, then returns to normal after the sun rises and the battery begins to charge again. This constraint is not a system failure, but an indicator that the system has worked in accordance with the principles of tool design engineering to prioritize the most important activities. Overall LCD display remains constant and clearly monitored.

Besides being displayed on the LCD, the water quality data measured by the system is then forwarded to the SD Card module for storage. The advantage of this technology storage system is that it separates different data sheet files based on the measurement date. The format of writing the file name is the date of measurement and data storage. Thus, users who process data will be greatly helped when selecting the required data, it is also easy to check the suitability or existence of the data. Budikdamber pond is shown in Figure 5. Notice the red box in Figure 5, that the storage process starts from January 25 to April 8, 2021. That is, the process of measuring water quality data and the process of observing growth fish begins and ends on that date, which is for three months and fifteen days. It can be seen that the storage process runs smoothly according to the working principle of the tool. This is evidenced from the data sheet every recorded date and stored every day.

In Figure 5 the brown check mark is an example of the contents of one of the data sheet files (4 April 2021). The contents of each data sheet are data for measuring water temperature and pH and the time of data collection. See the blue contact sign in Figure 5, if the data

sampling interval is every one second, then the maximum size of each data file per date is ± 1.88 MB. The amount can change, depending on the number of characters written on the SD Card. The maximum size stored will be smaller when the timing of the data sampling interval is slower, for example every ten minutes. The date and time settings can be changed from the file named "SETTING".

Figure 6. Sample of display of dazta file contents on SD Card E-Ox Level

Viewing a more detailed example of the display of the contents of the stored SD Card data file is shown in Figure 6. Figure 6 also only shows the representation of data stored at 00.00, 07.10, 10.59, 15.00, and 23.59 WIB. The interval between data rows and other data rows is every one second, so that in one day there are 96,861 rows of data. In each row there is information on pH and water temperature data and the time of sampling. This interval can be changed according to the user's wishes or according to the purpose of data observation.

Designing a system so that the stored data is automatically separated for each date is very helpful for data processing workers. As in the example in Figure 6, users can easily retrieve data on a certain date, then check its completeness, as well as filter and compare data patterns from each date. The results of checking the data from the entire measurement date are known that the data has been stored very neatly at the time and place. This is an indicator that the storage process test has met the expectations of the device design

B. E-Ox Level performance response test on catfish growth

Pool I is installed with E-Ox Level, pool II is installed with a standard AC aerator, while pool III is used as a control without an aerator. The schedule for observing fish growth patterns is routine, observed every two weeks for three months. Observations made on fish are aspects of weight and length. The results of these observations are shown in Table 2.

Table 2. Observation data on fish growth in Budikdamber ponds

Measurement Time		Measurement Type	Fish Samples from Pond I		Fish Samples from Pond II		Fish Samples from Pond III	
			Fish 1	Fish 2	Fish 1	Fish 2	Fish 1	Fish 2
Month 1	Week 2	Long (cm)	12,70	12,40	12,50	12,72	12,30	12,30
		Weight (g)	100,80	98,00	98,00	99,80	97,60	99,00
	Week 4	Long (cm)	13,90	13,10	13,10	13,20	12,50	12,40
		Weight (g)	110,00	103,90	109,90	103,49	99,20	98,40
Month 2	Week 6	Long (cm)	16,70	15,10	16,10	16,70	13,40	15,10
		Weight (g)	132,60	119,80	130,80	120,00	106,30	119,80
	Week 8	Long (cm)	21,10	20,10	21,00	21,20	15,10	19,20
		Weight (g)	167,50	159,50	166,50	159,10	119,80	152,40
Month 3	Week 10	Long (cm)	26,90	25,20	27,10	26,00	17,90	22,40
		Weight (g)	213,30	191,90	213,20	192,30	136,40	150,00
	Week 12	Long (cm)	31,50	28,00	31,90	29,10	23,00	25,00
		Weight (g)	250,00	150,00	251,10	151,00	142,00	170,00

The results obtained showed that the fish in the pond installed with the aerator grew faster, both with the E-Ox Level and the standard AC Aerator. Meanwhile, the fish in the control pond grew relatively slowly. The differences in fish growth with the help of E-Ox levels with AC Aerators are almost the same, so it cannot be determined which is superior in growth. However, the advantage of the E-Ox Level is that it does not use PLN's electrical energy, because it is completely substituted by solar energy stored in the battery. So, if this technology is used by a group of farmers, it will have a positive impact on reducing the burden of technology electricity expenditure and fish yields will increase. The information shown in Table 2 is data from two fish samples taken at random from a total of ten fish per pond.

Look at the pattern of fish mortality in each pond. In the first month there were no fish deaths in each pond, because the water was always changed once a week. However, in the fifth week, there were fish deaths in each pond, because the water was not changed for 21 days. The highest number of deaths occurred in pool III (control) as many as five individuals, while pools I and II were one. In the eighth and tenth weeks, only one fish died in pond III with one fish per week. This is due to the water not being replaced for fourteen days. The number of fish that were still alive at the end of the observation (third month of the twelfth week) were nine in ponds I and II and three in ponds III.

If you look at the pattern of growth and death of fish in each pond, the use of an aeration system using E-Ox Level and AC Aerators has a very positive impact. The advantage of E-Ox Level from standard Aeraor AC is that it can monitor water quality data in real time and store it on the SD Card, as well as control the activity of providing aeration in fish ponds continuously or by timing, and then the technology's power source completely uses energy from the sun..

Table 3. Pattern of fish mortality rate and final weight of fish in each pond

	Amount fish start	Initial total weight (g)	Observation	Month 1 Week - 1	2	3	4	Month 2 Week - 5	6	7	8	Month 3 Week -- 9	10	11	12	Final number of fish	Final total weight (g)
Pool I	10	626	Data kematian ikan	-	-	-	-	1	-	-	-	-	-	-	-	9	1490
Pool II	10	630		-	-	-	-	1	-	-	-	-	-	-	-	9	1520
Pool III	10	627		-	-	-	-	5	-	-	1	-	1	-	-	3	550

Conclusion

The display of water quality data on the LCD screen has worked according to the E-Ox Level design algorithm to prioritize the most important activities. The storage system records complete data starting from the installation date, which is January 25, until the device is released, which is April 8, 2021. The results of observations of fish growth in ponds I (E-Ox Level) and II (standard aerators) were faster than ponds III (control). The number of fish that were still alive at the end of the observation was nine in ponds I and II, while only three were in pond III. The final size of the total weight of fish in Pool I of 1490 grams is still smaller than the weight of fish in Pool II of 1520 grams. The relatively small difference in weight cannot directly determine the more aeration between the two. However, the advantage of the E-Ox Level is that it uses solar energy as a power source.

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