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Development of Combination of Environmentally Friendly Biofloc and Aquaponic Systems in the Maintenance of *Oreochromis niloticus*

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Abstract:- Biofloc technology is one alternative to overcome the problem of aquaculture environment water quality which is adapted from conventional waste management techniques. Aquaponics is a combination of aquaculture and hydroponic systems that is mutually beneficial. The purpose of this study was to determine the effectiveness of developing a combination of biofloc and aquaponic systems in the maintenance of environmentally friendly Tilapia (*Oreochromis niloticus*), in terms of water quality and tilapia development. This research method was designed in the form of Research and Development. The results showed that the water quality was in accordance with the quality standard. The average ammonia concentration was 0.016 mg / L, nitrit concentration was 0.008 mg / L, nitrate concentration was 20.8 mg / L and DO was 7.39 mg / L during maintenance. The conclusion of this study is that the development of a combination of biofloc and aquaponic systems in the maintenance of Tilapia is effective in maintaining water quality so as to minimize the occurrence of aquaculture waste. Biofloc systems can be applied to land and limited water availability. The development of Tilapia in the system can develop well. The development of a combination of biofloc and aquaponic systems in the maintenance of Tilapia (*Oreochromis niloticus*), is able to minimize the occurrence of waste aquaculture waste, thereby preventing pollution.Water quality in development ponds is suitable as a medium for maintaining Tilapia (*Oreochromis niloticus*).

Keywords:- *Aquaponics,Biofloc, Environmentally Friendly, Oreochromis niloticus.*

I. INTRODUCTION

A biofloc is a small flock or clumps composed of a collection of living microorganisms that hover in the water. Biofloc Technology is technology that utilizes the activity of microorganisms that form flocks. Biofloc formation occurs under certain environmental conditions (Azim et al, 2012).Aquaponics is a sustainable agricultural system that combines aquaculture and hydroponics in a symbiotic environment. In normal aquaculture, excretion from animals kept will accumulate in water and increase water toxicity if not removed (Roosta. H.R. 2014). Fox (2012) states that in the culture system elements Carbon (C), Nitrogen (N) and Posfor (P) in the body of fish which is a reflection of fish feed which is very small in the body, because it turns out that the food eaten by fish is only 20% - 30%, meaning 70% -80% remaining in ponds or sediments. The remaining 70% -80% is what can cause the source of disease, water quality decreases so that fish growth is less than optimal. The technique for managing residual feces and feed can be an attempt to provide the best environment for fish growth. Tilapia is a type of freshwater fish consumption. This fish was introduced from Africa, specifically eastern Africa, in 1969, and is now a popular fish in freshwater ponds in Indonesia as well as pests in every river and lake in Indonesia. Its scientific name is *Oreochromis niloticus*, and in English it is known as Nile Tilapia.

This research is important to examine the effectiveness of developing a combination of biofloc and aquaponic systems in the maintenance of tilapia. Is the system able to minimize the occurrence of aquaculture waste, thereby minimizing the occurrence of pollution and assessing the development of tilapia by the use of nutrients as natural food. It is expected that perpetrators of aquaculture will continue to prioritize the use of science and technology in the management of sustainable aquaculture businesses. The purpose of this study was to determine the effectiveness of developing a combination of biofloc and aquaponic systems in the maintenance of environmentally friendly Tilapia (*Oreochromis niloticus*), in terms of water quality and tilapia development.

II. MATERIAL AND METHOD

The application of biofloc technology is carried out in a round tarpaulin pond with a diameter of 150 cm, height, 100 cm. The application of the aquaponic system by installing pralon which is connected to the filter basket and water pump. Provision of maintenance water media is 1.5 m3 and fish density is 300 fish / m3 (Figure 1).

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Fig 1:- Series of development of environmentally friendly biofloc and aquaponic systems

In this activity the application of a combination of biofloc and aquaponic technology is carried out by adding a filter basket. Perforated plastic balls (Figure 2) and zeolite stones (Figure 3) placed in baskets serve to neutralize and increase oxygen levels (O_2), neutralize water pH and stimulate plankton culture more quickly, replace and absorb toxic chemical compounds that present in water such as N_2, NH_3 and CO_2, as controlling the degree of pollutants and ammonia that comes from manure and leftover food that is not well absorbed, maintaining water quality and stability.

Fig 2:- Filter basket containing jagged rubber balls

Fig 3:- Filter basket containing zeolite stones

At the beginning before the fish were stocked, probiotics were given, namely EM4 (Effective Microorganisms 4) floc forming at a dose of 5 cc / m3. The addition of probiotic bacteria is carried out along with the accumulation of feed given in the maintenance media for 42 maintenance days. Ammonia, nitrate, nitrite, dissolved oxygen (DO), temperature, pH and fish length measurements were taken during maintenance. Fish length measurement at the beginning and end of maintenance for 42 days was carried out randomly by taking a sample of 100 fish from a total population of 300 in the biofloc pond.

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III. RESULTS AND DISCUSSION

The application of a biofloc system combined with an aquaponic system can reduce water changes in the culture system so that this technology is considered environmentally friendly. Water from the biofloc pond will be flowed into the hydroponic circuit where in the circuit a filter basket is added as a filtering water that is passed in it. The results showed that the water quality was in accordance with the quality standard. The average ammonia concentration was 0.016 mg / L, nitrit concentration was 0.008 mg / L, nitrate concentration was 20.8 mg / L and DO was 7.39 mg / L during maintenance (Table 1).

Parameters	Day-0	Day-21	Day-42
Ammonia (mg/L)	0.015	0.02	0.013
Nitrite (mg/L)	0.0080	0.0081	0.0079
Nitrate (mg/L)	20.81	19.79	21.80
Temperature (^{0}C)	26	28	28
DO (mg/L)	5.2	8.4	8.57
pH	6	6	7

Table 1:- Data on Pond Water Quality Development of a Combination of Biofloc and Aquaponics in Tilapia Maintenance

The ammonia content for 42 days, with sampling on day 0, day 21 and day 42, is presented in Figure 4.

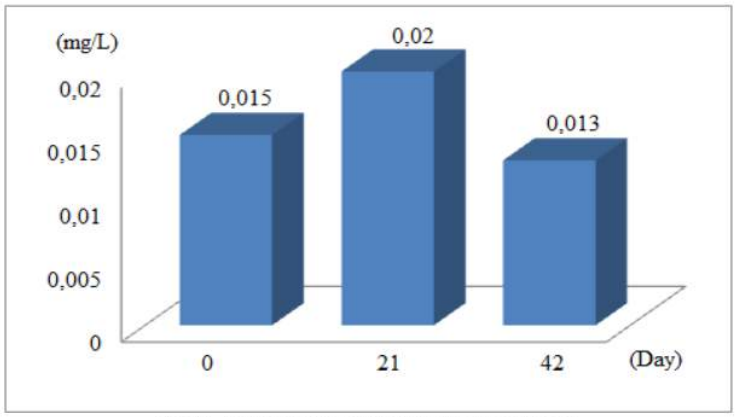

Fig 4:- Ammonia Content in Development Pools

From Figure 4. it can be seen the average ammonia content of 0.016 mg / L, which means the ammonia content in the pond is still below the quality standard. This condition can occur due to the presence of bacteria that can break down waste from fish, namely the Nitrosomonas bacteria, which convert Ammonia to Nitrite, Nitrites are then converted to Nitrates by the Nitrobacter bacteria. According to SNI 7550: 2009 requirements, the maximum limit of ammonia levels for fish farming activities is <0.02 mg / L.

Based on Waluyo (2007) research, asserted that decomposition of ammonia by microbes can be done by deamination process. Deamination is the process of dismantling proteins into amino acids, then amino acids are broken down into ammonia and some other substances by the urease-producing bacteria. The urease enzyme breaks down urea to ammonium carbonate, while ammonium carbonate readily breaks down into ammonia, carbon dioxide and water, also emphasized by Gianfreda and Bollag (1996) that the urease enzyme is the only catalyst enzyme in hydrolyzing urea. George *et al*. (2011) added that the genus Bacillus is a microbe from a class of bacteria that is able to synthesize urease well in waters. Furthermore, a series of development of environmentally friendly biofloc and aquaponic systems with tomato and eggplant plants can be seen in Figure 5 and Figure 6.

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Fig 5:- Series of development of environmentally friendly biofloc and aquaponic systems with tomato plants

Fig 6:- Series of development of environmentally friendly biofloc and aquaponic systems with eggplant plants

In this series of potted plants as planting media were given gravel and coconut fiber. Gravel is a growing medium that functions almost the same as sand. Most farmers who use this gravel growing media to get space for roots to grow optimally. Not only that, gravel can also help the circulation of nutrient solutions and the air. Coconut coir dust as a planting medium is claimed to have a high water capacity. Coconut coir powder is known to be able to store water up to 73% or 6-9 times the volume.

The application of a biofloc system combined with an aquaponic system will reduce water changes in the cultivation system so that the technology is environmentally friendly. The feed used is even less than other conventional systems. The benefits and benefits of the system saves pellet feed, tilapia fish growth is more uniform and easier, healthy and agile fish and can reduce fish pests / diseases. In addition to these benefits some other advantages of the system are that it can save land, because of high stocking densities, the appearance of ponds is more beautiful, especially if using round ponds, the management of feed, water and layout is easier, not as complex as ground ponds and more efficient feeding time only twice a day.

Fish length measurement at the beginning and end of maintenance for 42 days was carried out randomly by taking a sample of 100 fish from a total population of 300 in the biofloc pond. The average fish length at the beginning of maintenance is 12 cm and the average fish length at the end of maintenance is 14.5 cm (Figure 7 and Figure 8).

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Fig 7:- Measurement of initial maintenance of Tilapia (*Oreochromis niloticus*)

Fig 8:- Measurement of final Tilapia (*Oreochromis niloticus*) rearing

While Rakocy, (2006); Sastro, Y (2015) states that aquaponics can be described as an amalgamation of aquaculture (fish culture) systems and hydroponics (plant or vegetable cultivation without soil media). This system adopts an ecological system in the natural environment, where there is a symbiotic relationship between mutualism of fish and plants. Environmentally friendly biofloc and aquaponic development systems can reduce water replacement because there is a water purification cycle process that will turn food waste and toxic gases such as ammonia and nitrite into harmless compounds. By minimizing the replacement of water, the opportunity for entry of germs from outside can be reduced. Water replacement is usually only done to replace water that is evaporating or seeping. The system is more stable than the usual probiotic system because biofloc is a bacterium that does not stand alone, but in the form of floc or a group of several floc-forming bacteria that synergize with each other (Avnimelech Y. 2012).The development of a combination of biofloc and aquaponic systems in the maintenance of Tilapia (*Oreochromis niloticus*), is able to minimize the occurrence of waste aquaculture waste, thereby preventing pollution.Water quality in development ponds is suitable as a medium for maintaining Tilapia (*Oreochromis niloticus*).

IV. CONCLUSIONS

The results showed that the water quality was in accordance with the quality standard. The average ammonia concentration was 0.016 mg / L, nitrit concentration was 0.008 mg / L, nitrate concentration was 20.8 mg / L and DO was 7.39 mg / L during maintenance. The conclusion of this study is that the development of a combination of biofloc and aquaponic systems in the maintenance of Tilapia is effective in maintaining water quality so as to minimize the occurrence of aquaculture waste. Biofloc systems can be applied to land and limited water availability. The development of Tilapia in the system can develop well.

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