Monitoring of Water Quality on Rearing Intensive Ponds of Vannamei Shrimp (Litopenaeus Vannamei) In CV. Tirta Makmur Abadi Lombang

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Abstract

Vannamei shrimp (Litopenaeus vannamei) is a fishery commodity that has a very important value in the international market. Water quality monitoring is one of the key factors in the success of cultivation. Water quality plays an important role in determining the growth and survival of vaname shrimp. The parameters measured in this study were brightness, color, pH, DO, temperature, salinity, total alkali, TOM, ammonium, nitrite and phosphate. The purpose of this study was to determine the condition of the water quality in the vaname shrimp (Litopenaeus Vannamei) pond in CV. Tirta Makmur Abadi Lombang.

Keywords : *Litopenaeus vannamei*, monitoring, water quality

Introduction

Vaname shrimp (*Litopenaeus vannamei*) is an important commercial shrimp species in Indonesia and is one of the leading fishery products in the fisheries sector (Kaligis, 2015). Vannamei shrimp farming technology is also growing with the birth of intensive and supra-intensive technology to achieve high stocking densities ranging from 100-400 fish/m² (Nababan *et al*., 2015). The application of intensive cultivation patterns is very beneficial because it can use high stocking densities, so as to increase vannamei shrimp production.

Panggabean *et al.* (2016), stated that the development of intensive aquaculture is characterized by an increase in the density of organisms and feed supply, all of which use artificial feed. The problem that then arises is the decline in water quality caused by the accumulation of residual feed, organic matter, phosphate compounds and toxic nitrogen due to the low speed of water turnover. Water quality management for aquaculture purposes is very important, because water is a living medium for aquaculture organisms. In line with the statement of Supono (2018), semi-intensive and intensive shrimp farming has serious problems regarding water quality degradation. Stocking density and feed input are high which causes high waste generated both suspended and settled at the bottom of the pond.

The higher the stocking density, the higher the increase in metabolic waste. The rest of the feed will settle into feces at the bottom of the pond and turn into toxic compounds for shrimp due to a decrease in water quality (Wulandari, 2015). Ritonga et al. (2021), stated that water quality management has a very important role in the success of shrimp farming. Water quality is one of the factors that are key to the success of shrimp farming. A decrease in water quality will cause shrimp stress and cause disease so that it often causes failure in shrimp enlargement activities.

Based on the importance of water quality in supporting the success of intensive vaname shrimp farming, quality management is very necessary and the need for routine water quality monitoring.

Materials and Methods

The study was conducted at CV. Tirta Makmur Abadi Lombang which is located in Pakembangan Village, Batang-batang District, Sumenep Regency, East Java on March 1 to May 7, 2021. This study uses descriptive methods.

The materials used in this study are water samples in ponds B1 and B2, probiotics, water treatment materials namely heromin, azomite, MgCl. Fermentation materials are fine bran, molasses, yeast, azomite and fresh water. Pond water quality parameters (B1 and B2) monitored were brightness, color, pH, DO, temperature, salinity, total alkali, TOM, ammonium, nitrite and pospate.

Result and Discussion

General condition of the study site

The shrimp enlargement pond is made of a round pond with a diameter of 34 with an area of 907m² with a height of 2 m equipped with an inlet, a control basin with an outlet and a central drain in the middle of the pond and coated with HDPE (High Density Polyethylene) plastic with a thickness of 0.5 mm to reduce the risk of water seeping into the ground and to facilitate the management of pond water and has a very high resistance to UV exposure.

The main source of dissolved oxygen in CV. Tirta Makmur Abadi Lombang uses a blower and wheel, the installation of aeration stones is carried out at the bottom of the pond with a distance of 3 meters for each aeration with a total of 68 aeration points. For the number of wheels installed diameter 34 amounted to 2 wheels with 2 HP power (double paddle whell). The wheel is arranged in a parallel pattern so that the current generated evenly and dirt at the bottom of the pond can be collected at the center point (central drain).

Preparation of Pond

The preparation of pond media water is done by pumping the borehole to the settling tank plot with a drill water salinity of 10 ppt, then flowed to the map using a pump. At the beginning of the preparation of media water, treatment is not carried out on the reservoir because treatment is carried out directly on the plots. Treatment is done by adding types of minerals to the plots such as heromin 2 ppm, azomite 0.5 ppm, MgCl 0.5 ppm which functions as a mineral enhancer in water because in low salinity water the mineral elements contained in water are very low, therefore the addition of minerals is needed. This type of mineral is needed for the metabolic process and the growth of all organisms in the pond both shrimp, bacteria and plankton.

Plankton growth is done by fermentation application, with ingredients of 3 kg fine bran, 0.5 L molasses, 150 grams yeast, 0.5 kg azomite and fresh water. The ingredients are mixed and then allowed to stand in a closed container for 2 days without aeration, then after 2 days can be spread on the plots by taking the juice of the fermented ingredients by squeezing and discarding the substrate. As well as the addition of Herobacillus probiotic type 1 ppm containing Bacillus subtilis, Bacillus lincheniformis, Pseudomonas putida, Saccharomyces cerevisiae which serves to optimize the pond environment by increasing the dominance of beneficial bacteria and the provision of Super PS probiotics with Rhodobacter sp bacteria that function to break down Hydrogen Sufride (H2S) and organic materials at a dose of 3 ppm. This is in accordance with the opinion of Ghufron et al. (2017), that the growth of organisms and plankton is done by the application of fermentation as a nutrient for microorganisms in waters and the application of probiotics.

Water Quality Monitoring

Water quality monitoring includes water brightness, water color, water pH, DO, temperature, salinity, total alkali, TOM, ammonium, nitrite, pospate.

Brightness

Water quality measurements at CV. Tirta Makmur Abadi Lombang was done twice, namely in the morning at 06.30 WIB and in the afternoon at 14.30, brightness measurements were taken using a secci disk brightness measurements can be seen in Figure 1.

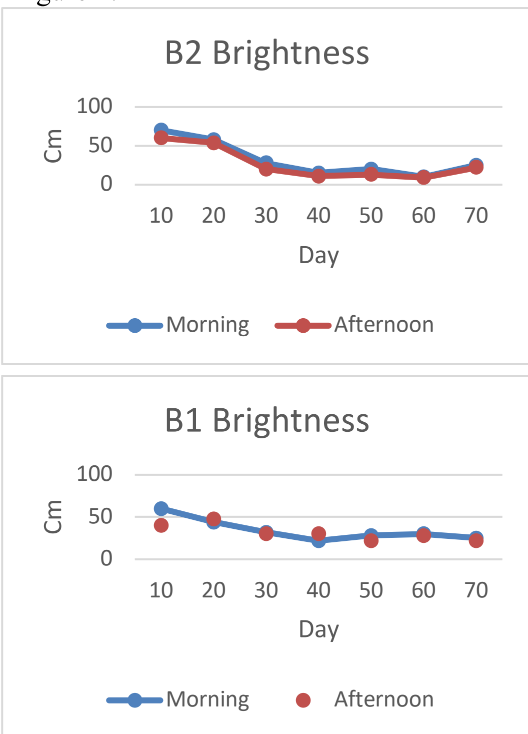


Fig 1: Brightness (Primary Data 2021).

Based on the measurement of brightness in plot B2 the brightness value is 10 - 90 even on the brightness of the water in plot B2 most concentrated in DOC 30 to harvest, while in plot B1 brightness fluctuations also vary but in plot B1 brightness is not up to the value of 10, for example in DOC 30 - harvest brightness ranges in value 20 - 50. This indicates that the increasing DOC shrimp then the water in the plot is also increasingly concentrated this is due to the high organic matter in the pond derived from feed, dung and fermentation so that the brightness will decrease, the high organic matter is utilized by Phytoplankton as nutrients and can also cause a decrease in the brightness of the pond water.

As for the factors that affect the high and low brightness of the pond water are weather factors, plankton density, measurement time and accuracy of people in the measurement. Too low brightness is also not good because it can interfere with the process of photosynthesis and decomposition of organic matter that can be toxic if too dense (Putra and Mannan, 2014). To overcome too much brightness, watering is done and also treatment in controlling plankton, water changes, and good feed management so that there is no accumulation at the bottom of the plot.

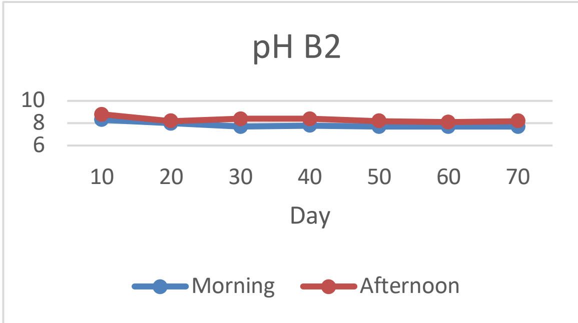
Water color

Pada DOC awal warna air di CV. Tirta Makmur Abadi Lombang berwarna hijau seiring bertambahnya masa pemeliharaan udang air akan sering berubah, hal ini disebabkan oleh bahan organik yang terlarut pada air yang menyebabkan terjadi perubahan, seperti pada petak B2 warna air cenderung berwarna coklat sedangkan pada petak

In the early DOC, the color of water in CV. Tirta Makmur Abadi Lombang is green as the maintenance period of shrimp water will often change, this is caused by organic matter dissolved in water that causes changes, such as in plot B2 water color tends to be brown while in plot B1 water color green brown and brown. Erlangga (2012), states that changes in the color of pond water generally illustrate the instability of the environment in the pond. Giving probiotics during the maintenance period has a positive impact on stabilizing plankton so that it has a direct impact on the color of the pond water that tends to remain stable.

Potential Hydrogen (pH)

Measurement of water pH at CV. Tirta Makmur Abadi Lombang is done every day. The graph of water measurements in plots B2 and B1 in Figure 2.



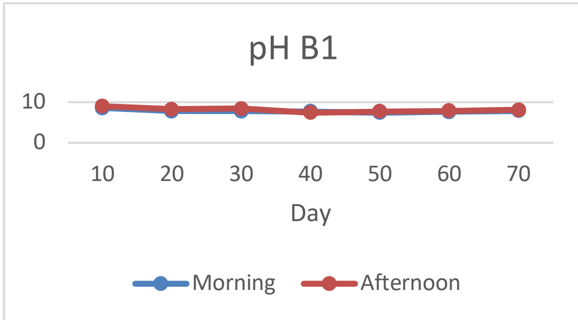


Fig 2. pH (Primary data, 2021)

Based on the graph above, the pH value varies greatly with the pH range in plot B2 which is 7.7 - 8.0 while the pH in plot B1 ranges from 7.7 - 8.4. It can be seen the comparison of pH in the morning and evening, pH in the morning tends to be lower than in the afternoon. This occurs because at night the plankton does not carry out the process of photosynthesis but only respires and produces CO_2 so that the pH tends to be low in the morning, while in the afternoon to evening photosynthesis occurs so that the pH becomes high because during the photosynthesis process the CO_2 concentration decreases, thereby increasing the pH of the water. Referring to SNI (2014), which states that the optimum pH range for shrimp farming is 7 - 8.5.

***Dissolved oxygen* (DO)**

DO measurements are carried out every day considering that DO in the round pond is not good enough by relying only on the wheel and blower. The DO measurement graph can be seen in Figure 3.

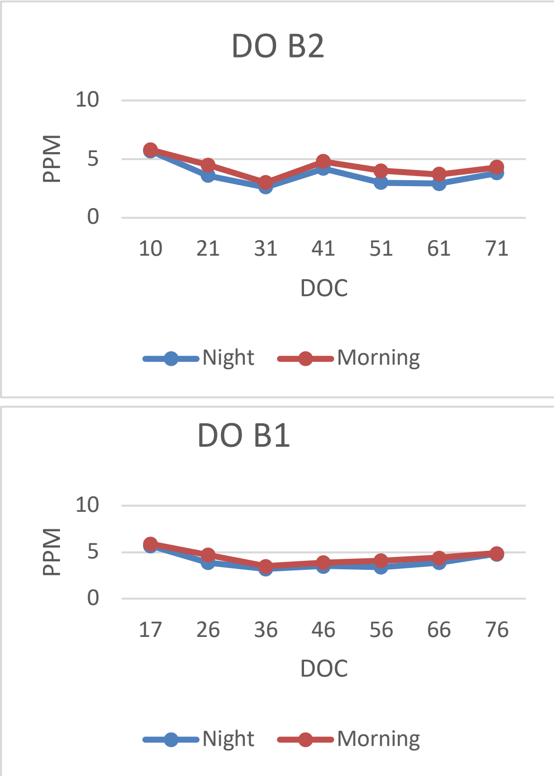


Fig 3. *Dissolved oxygen* (Primary Data, 2021).

Based on the graph above shows that at night DO is lower than DO in the morning, this happens because shrimp are nocturnal or active at night so that the use of dissolved oxygen in the morning is more. On the graph it can be seen that DO fluctuations in plot B2 and Plot B1 are still quite good with a DO range of 3.5 - 4.0, but in plot B2 when DOC 20 - 30 DO had decreased with a DO range of 1.5 - 2.5. In contrast to the opinion of Purnamasari (2017), that in intensive shrimp ponds the dissolved oxygen content for shrimp life ranges from 4 - 8 ppm, this decrease occurs due to the lack of a wheel, a decrease in DO can occur due to the density of plankton so that DO becomes low due to many microorganisms that utilize DO while DO during the day increases because plankton photosynthesize by utilizing sunlight so that DO increases, not only that the maximum use of the wheel can also increase DO.

Temperature

Temperature measurements were carried out simultaneously with DO measurements.Temperature measurements can be seen in Fig 4.

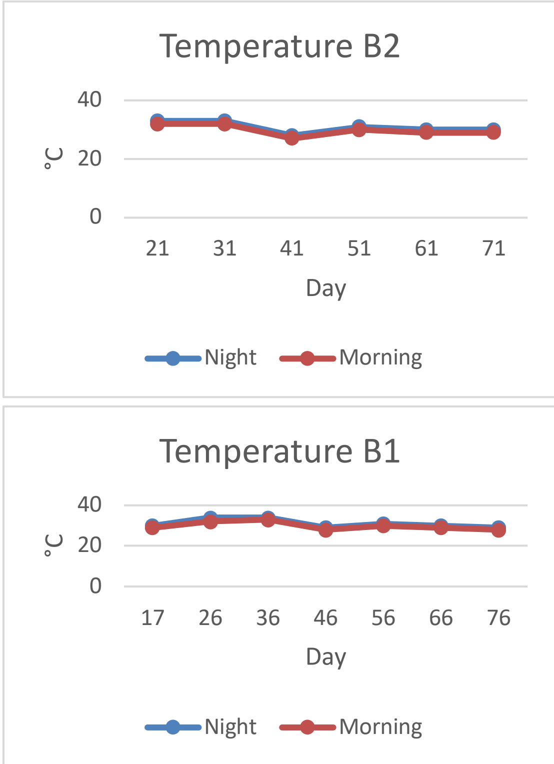


Fig 4. Temperature (Primary Data, 2021).

Based on the graph, it can be seen that temperature fluctuations in plots B2 and B1 are still stable with temperatures ranging from 30 - 33. Referring to SNI (2014), that the water temperature for shrimp farming ranges from 28 - 33 ° C, temperature changes are influenced by sunlight, air temperature, and weather. Extreme fluctuations in the waters of vaname shrimp ponds can reduce the appetite of vannamei shrimp, so it will inhibit its growth.

Salinity

Salinity measurements on the plots ranged from 11 - 13 ppt. These results are still within the optimal range of SNI (2006), that the range of good salinity for shrimp is 10 - 35 ppt.

Low salinity due to the use of water sourced from boreholes so that salinity tends to be lower, therefore every afternoon MgcL treatment or mineral treatments such as heromin azomite. The salinity measurement graph can be seen in Figure 5.

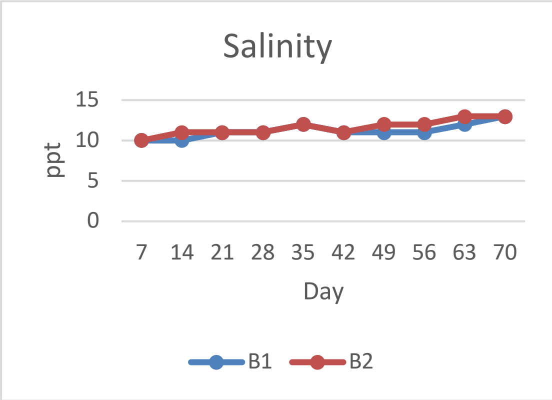


Fig 5. Salinity (Primary data, 2021).

Alkalinity

Alkalinity measurement is done in the morning by titration. Based on SNI standards (2006), that the range of alkalinity for vannamei shrimp farming is 100 - 150 ppm. Alkalinity measurements can be seen in Figure 6.

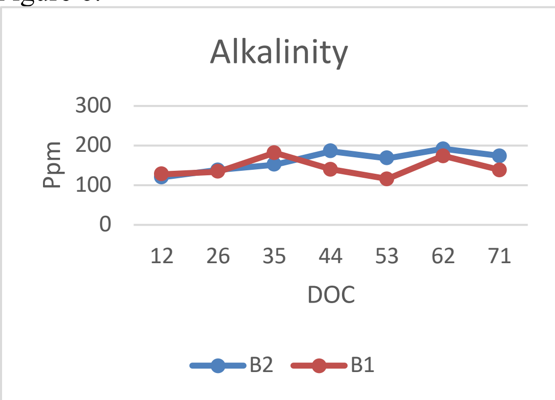


Fig 6. Alkalinity (Primary data, 2021)

Based on the graph above in plot B2 alkalinity is high in DOC 62 with a total alkali of 192 while in plot B1 the total alkali is high in DOC 35 with a total alkali of 182. Total alkali in plot B2 tends to increase compared to plot B1 where the lowest total alkali in DOC 53 with a total alkali of 116. SNI (2006), states that the range of alkalinity for vannamei shrimp farming is 100 - 150 mg/l.

Total Organic Matter **(TOM)**

Measurement of total organic matter (TOM) is carried out every seven days in the morning by titration. TOM measurement aims to measure the total dissolved organics contained in water. The dynamics of TOM in plots B2 and B1 can be seen in Figure 7.

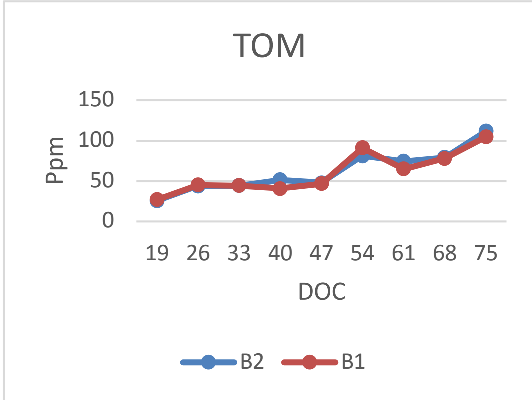


Fig 7. TOM (Primary data, 2021)

The measurement results on the graph show that the total organic matter in plots B2 and B1 tends to increase as DOC increases in shrimp such as DOC 54 and DOC 75 with total organic matter (TOM) in plot B2 which is 111.60 and in plot B1 which is 104.7. The high total organic matter can be detrimental when shrimp farming this occurs due to residual feed, dead plankton, as well as precipitation from water changes.SNI (2006), states that the maximum limit for the amount of organic matter cadence in ponds is <55 mg/l. To overcome the high total organic meter can be done by fixing, penyiponan, and giving molasses.

Ammonium (NH4)

Ammonium measurements are carried out once in a five-day vulnerability to minimize cost expenditures. Ammonium measurements serve to determine how much plankton nutrition and bacterial metabolic products are produced. Ammonium measurements can be seen in Fig 8.

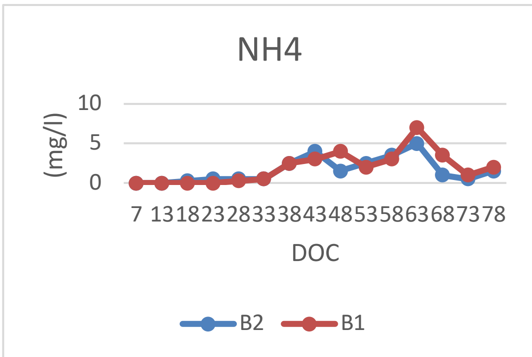


Fig 8. NH4 (Primary data, 2021)

DOC 1 - 13, the result is 0 (mg/l) in plot B2 while plot B1 obtained the lowest result at DOC 1 - 18 which is 0 (mg/l). While the highest measurement result of plot B2 is at DOC 63 with an increase in ammonium of 5 (mg/l), even on plot B1 the ammonium level is up to 7 (mg/l). This result is not in accordance with the opinion of SNI (2006), that the maximum ammonium content is 0.3 mg/l. The high level of ammonium occurs due to the shrimp pond CV. Tirta Makmur Abadi Lombang is not done penyiponan but rather the disposal of sewage at the bottom of the existing central drain only.

Nitrit (NO2)

NO2 measurements are carried out every five days with the aim of saving expenses, measuring NO2 using the NO2 test. NO2 measurements on plots B2 and B1 can be seen in Figure 9.

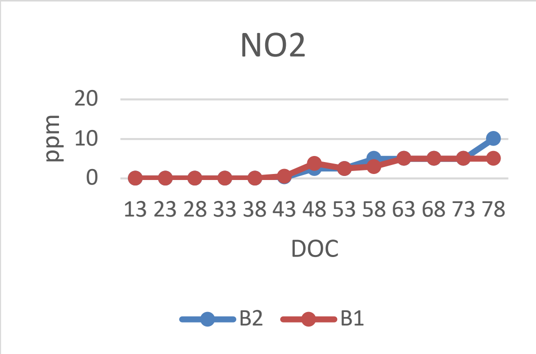


Fig 9.NO2 (Primary data, 2021)

The results of NO2 measurements in plots B2 and B1 showed the lowest results in DOC 1 - 43 with 0 ppm while in plot B2 at DOC 78 high NO2 measurements with 10 ppm, while in plot B1 DOC 63 - 78 nitrite measurements were always high with 5 ppm. Referring to SNI (2006), the maximum nitrite content is 0.01 mg/l, this is due to the accumulation of organic matter at the bottom of the plot and also the lack of piping.

Phospate (PO4)

PO4 measurements of shrimp ponds CV. Tirta Makmur Abadi Lombang is done every five days Posphate (PO4) is one source of nutrients that are needed by plankton to grow because in PO4 there are phosphorus compounds which are the main ingredients of plankton nutrition. The PO4 measurement graph can be seen in Figure 10.

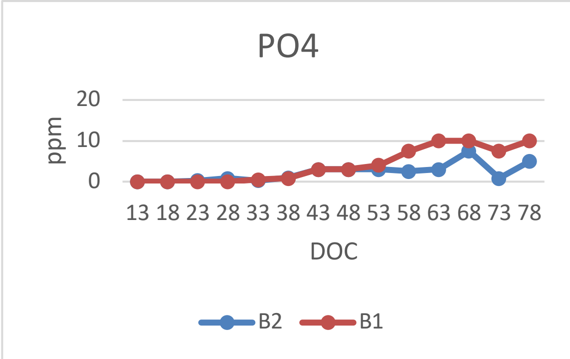


Fig 10.PO4 (Primary data, 2021).

PO4 measurements of shrimp ponds CV. Tirta Makmur Abadi Lombang is the lowest in DOC 1 - 18 with a measurement result of 0 ppm, while in plot B1 the measurement results are quite high in DOC 58 - 79 with a result of 7 - 10 ppm, the highest measurement of PO4 in plot B2 is in DOC 68 with a result of 7.5. The high PO4 in plots B2 and B1 is caused by residual feed, feces, and dirt from the water, PO4 is a source of nutrients for plankton, this condition is not good for waters because it can cause plankton blooming, it can be seen in plot B2 DOC 73 PO4 content decreases, this can occur because the phosphorus content in PO4 has been utilized by plankton. Referring to SNI (2006), the minimum PO4 value is 0.1 mg/l.

Conclusion

From the results of research on "Monitoring Water Quality in Vanamei Shrimp Enlargement Ponds (Litopenaeus vannamei) Intensively in CV. Tirta Abadi Lombang obtained the conclusion that the water quality in the pond still meets the growth standards of vaname shrimp. The results of water quality measurements such as TOM content on plot B2 reached 80 ppm and on plot B1 reached 104 ppm, measurement of nitrite B2 5 ppm plot B1 10 ppm, ammonium plot B2 5 ppm plot B1 7 ppm, PO4 plot B2 7.5 ppm plot B1 10 ppm and still at the tolerance limit which still supports the cultivation of vannamei shrimp.

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