

Bioremediation on the culture of *Macrobrachium rosenbergii* (De Man, 1879) in biofloc aquaponics technology with filter systems

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Abstract. The filter system in giant prawn cultivation continues to be developed. Filters function to increase oxygen levels, neutralize pH, breed plankton, absorb pollutants from dirt and leftover feed, and maintain pond water quality to provide better water quality results. This research aimed to analyze water quality from the development of filter systems, the nutritional value of biofloc, and the growth of giant prawns. This research used giant prawn seeds aged 2 months with an average length of 5 cm and a weight of 5 grams. The number of giant prawns stocked was 300 in ponds with a water volume of 2770 L/pond. Observation of the growth of weight and length of giant prawns was measured by sampling 30 individuals/pond. Data were analyzed using ANOVA, followed by further tests. There were three treatment units: without a filter P0, a single filter P1, and a double filter P2. The highest average weight of giant prawns was found in the double filter treatment P2, which was 15 g. The highest average absolute length of giant prawns was found in P2, which was 16 cm. The research results show that the use of the double filter is classified as efficient. The present study demonstrates that the addition of a filter affected DO level and the nutritional value of biofloc, including carbohydrate, protein, and fat, and significantly enhanced the growth performance of giant prawns seen from the weight and length. There is no effect on the water quality, including NH₃, NO₂, NO₃, DO, BOD, COD, and pH.

Key Words: aquaponics, biofloc, eco-friendly, filter, giant prawns.

Introduction. Giant prawns, *Macrobrachium rosenbergii* (De Man, 1879), are a shrimp commodity that has an economic price and is the largest shrimp compared to other types of shrimp (Purnamasari 2023). Giant prawn cultivation has developed quite rapidly, especially in the enlargement sector. The success of giant prawn farming is closely related to water quality. During the growth process, protein metabolism by aquatic organisms produces ammonia as a result of excretion. The protein in feces and uneaten feed will be broken down by bacteria; therefore, more intensive cultivation will lead to a higher concentration of ammonia (Wahyuningsih & Gitarama 2020). Several factors affect the concentration of ammonia: the source of the pollutant comes from uneaten fish feed residue, fish metabolic waste, and the resulting waste has exceeded the carrying capacity of the aquaponic system; the performance of bacteria in biofloc and nitrifying bacteria are not optimal in breaking down ammonia into nitrites (Deswati et al 2023).

The biofloc technology is used to recycle and transform waste and excessive nutrients, NH₃-N and NO₂-N, generated from feces and uneaten feed into microbial biomass. These biomasses are generally high in protein and utilized by cultured animals *in situ* as a nutrient source for feeds. This is achieved by steering the carbon and nitrogen ratio (C/N ratio) through modification of feed carbohydrate content or carbon source addition in water (Avnimelech 1999; Kuhn et al 2009; Crab et al 2012; Ekasari et al 2014; Fatimah et al 2019; Hostins et al 2019).

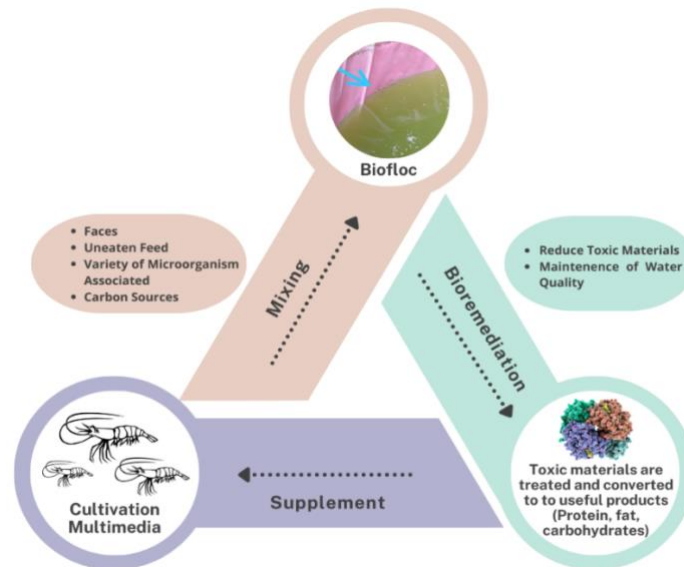


Figure 1. In situ biofloc technology (Original contribution: Corel Draw program).

Based on Figure 1, a schematic of an in situ biofloc technology, with input (energy for mixing and aeration, feces, uneaten feed, variety of microorganisms associated, carbon source) and control requirements as well as the outputs (nitrate, giant prawns, and microbial protein). Ensuring optimal water quality required by the cultivated species is key to obtaining the maximal growth rate and yield. Biofloc technology is responsible for maintaining good water quality for the removal of toxic nitrogen. Toxic materials are treated and converted to useful products (protein, fat, and carbohydrates).

Biofloc technology plays an essential role in bioremediation, in the maintenance of water quality, and conversion of toxic nitrogen. Water exchange is the most common method of limiting the concentration of ammonia, requires large amounts of water, and can pollute the surrounding cultivation media if the discharged water is not given further treatment (Avnimelech 2012).

Bioflocs contain a high number of heterotrophic beneficial microbial communities. The analysis revealed that 90% biofloc microbial population comprised *Vibrio* sp., while *Bacillus*, *Lactobacillus*, *Pseudoalteromonas*, *Clostridium*, *Shewanella*, *Acinetobacter*, *Photobacterium*, *Alteromonas*, *Marinifilum*, and *Pseudomonas* were also identified (Tepaamorndech et al 2020).

Microbial bioremediation is among the most preferred ways to remove toxic material, as it is cost-effective and able to immobilize contaminants efficiently (Gadd 2000) using beneficial microorganisms (Behera et al 2020; Das et al 2020). It is achieved by inducing the biological process that leads to the reduction, removal, and conversion of the contaminated material (Jasmin et al 2020). These microorganisms act as potential bioremediation in biofloc, leading to improved water quality, growth performance, and health of cultured aquatic animals (Adel et al 2017). Dissolved organic matter originating from feed, feces, and dead organisms is first and foremost utilized by heterotrophic bacteria. In outdoor biofloc technology, sunlight promotes microalgal growth as well (Yun et al 2022) (Figure 2).

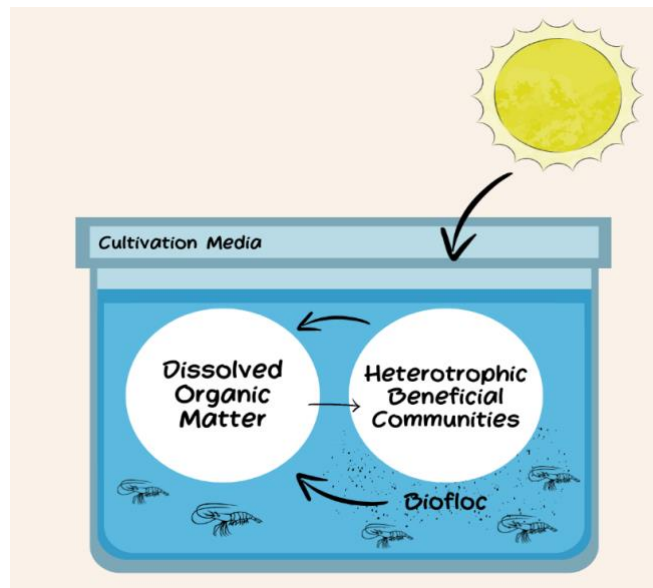


Figure 2. Biofloc technology in an outdoor setting.

Biofloc aquaponics can reduce water turnover in Giant prawn cultivation, so this technology is considered environmentally friendly. More beneficial effects of the biofloc technology have been discovered, including the nutritional properties, exogenous digestive enzymes contribution, potential control of pathogens, and immunostimulatory effects (El-Sayed 2021). Bioflocs can enhance the non-specific immune systems of cultured species by providing a wide range of immunostimulatory effects against microbial infections. Water from the biofloc technology is channeled into a hydroponic circuit where a filter basket containing bio-balls and zeolite stones is added as a filter media for the water that is passed through it (Gadd 2000). Bio-balls are used as substrates to optimize the performance of bacteria (Deswati et al 2022).

The function of the filter is to increase oxygen levels, neutralize pH, breed plankton, absorb pollutants from dirt and leftover feed, and maintain pond water quality. The problems to be studied are solving problems related to water quality, utilization of nutrients as natural feed by analyzing the nutritional value of biofloc, and reducing waste pollution in giant prawn cultivation by improving the filtration system. The application of biofloc technology in red tilapia culture may improve the water quality and fish survival as well as reduce external feed requirements (Ekasari & Maryam et al 2012). This research aimed to analyze water quality from the development of filter systems, the nutritional value of biofloc, and the growth of giant prawns.

Material and Method. The research was conducted from September to November 2023 (90 days) at the Biology Education Laboratory UPGRIS, Semarang, Central Java, Indonesia. This research used giant prawn seeds aged 2 months with an average length of 5 cm and a weight of 5 grams. The number of giant prawns stocked was 300 in ponds with a water volume of 2770 L in each pond. Measurements of water quality, including NH_3 , NO_2 , NO_3 , DO, BOD, COD, and pH, as well as the nutritional value of biofloc, including carbohydrate, protein, and fat, were carried out at the Chemistry Laboratory, FMIPA UKSW Salatiga, Central Java, Indonesia. Measurement of the growth of giant prawns follows the research method of (Purbomartono et al 2022).

This research used a completely randomized design with three treatments, namely (P0) biofloc aquaponics without a filter as control, (P1) with a single filter, and (P2) with a double filter. The variables observed in this research were the increase in weight and length of giant prawns and water quality indicators. Measurements of Weight Gain (WG) and Length Gain (LG) follow the guidelines of (Purbomartono et al 2022) as follows: $\text{WG} = \text{Wt} - \text{Wo}$; $\text{LG} = \text{Lt} - \text{Lo}$, where Wt: final weight; Lt: final length; Wo: initial weight; Lo: initial length; WG: weight gain; LG: elongation after 90 days of maintenance. Observations were made at the end of the study. The growth of giant prawns was

observed by taking 30 giant prawns/ponds. Tools used in this study included tarpaulin ponds, aerators, gutters, water pumps, PVC pipes, plastic buckets, bioballs, pots, coconut fiber, and rock wool. Materials used in this research include eggplant, giant prawns, and pellets. Measurements of growth in weight and length of giant prawns were carried out three times during the research. Observation of the growth of weight and length of giant prawns was measured by sampling 30 individuals/pond. ANOVA was used to analyze research data.

Results. The use of an environmentally friendly biofloc aquaponic that has been applied in the treatment of giant prawn cultivation has proven to be very efficient in the use of water. In a pond with a diameter of 2.0 m and a height of 1.25 m, it is filled with 2.77 m³ of water or the equivalent of 2770 liters. Until the eighth week, the water has not been refilled. These conditions indicate that the use of water in biofloc aquaponics is efficient. The addition of water was carried out again in the 12th week, as much as 5 m³, or equivalent to 500 liters. The reduction of water in the pool can be caused due to the evaporation process that occurs naturally (see Table 1). This can happen because water molecules rise to the surface, form vapor, and are finally released into the air.

Table 1

Environmental conditions, water quality

<i>Environmental conditions water quality</i>	<i>Treatment</i>			<i>Standard (mg L⁻¹)</i>
	<i>P0</i>	<i>P1</i>	<i>P2</i>	
NH ₃	0.02	0.015	0.01	<0.02*
NO ₂	0.06	0.065	0.059	0.06 **
NO ₃	10.6	10.5	10	20 **
DO	4.6	5.0	6.3	>3**
BOD	3.3	3.6	3.2	<3*
COD	32	33	32	60**
pH	7.2	6.9	7	6-9**

(Source: *SNI 7550: 2009 and **Government Regulation of the Republic of Indonesia No.82 of 2001).

A series of environmentally friendly biofloc, aquaponic, and cultivated plants can be seen in Figures 3 and 4.



Figure 3. Biofloc aquaponics.



Figure 4. Cultivated plants in the biofloc aquaponics.

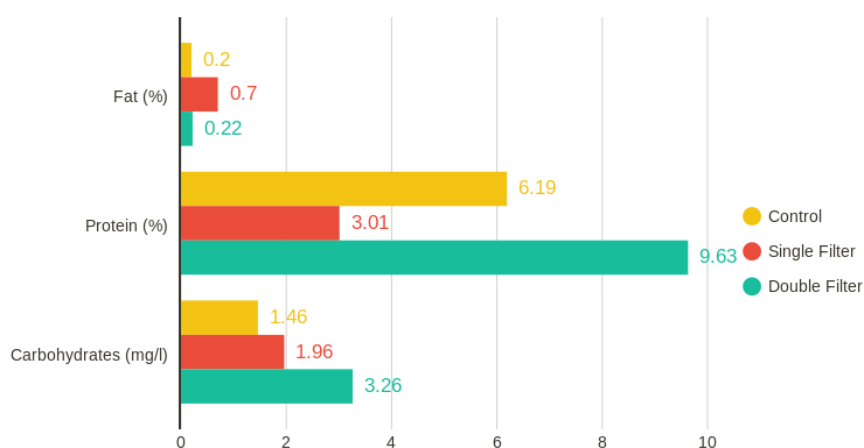


Figure 5. The nutritional value of biofloc.

The content of carbohydrates, proteins, and fats as a result of the analysis is a representation of the nutritional value of biofloc (Figure 5). Based on the average biofloc performance treatment in environmentally friendly biofloc-aquaponic ponds (Figure 5), statistical analysis was then carried out through the ANOVA test, including carbohydrate, protein, and fat content, as presented in Tables 2, 3, and 4. Based on ANOVA for carbohydrate, protein, and fat, the results were p value < 0.05 . It can be concluded that the average carbohydrate (Table 2), protein (Table 3), and fat (Table 4) content in each treatment is significantly different.

Table 2

Results of ANOVA for carbohydrate

Source of variation	Sum of squares	df	Mean square	F	Significance (p-value)
Between groups	5.18	2	2.59	25.9	0.000
Within groups	0.001	6	0		
Total	5.181	8			

Table 3

Results of ANOVA for protein

Source of variation	Sum of squares	df	Mean square	F	Significance (p-value)
Between groups	65.77	2	32.885	164.426	0.000
Within groups	0.001	6	0		
Total	65.772	8			

Table 4

Results of ANOVA for fat

Source of variation	Sum of squares	df	Mean square	F	Significance (p-value)
Between groups	0.481	2	0.24	35.881	0.000
Within groups	0.04	6	0.007		
Total	0.521	8			

Growth is a change in size, both length and weight, within a certain period (Akter et al 2017). Meanwhile, energetically, growth is expressed by changes in the total energy content of the body over a certain period (Luh S. M et al 2022).

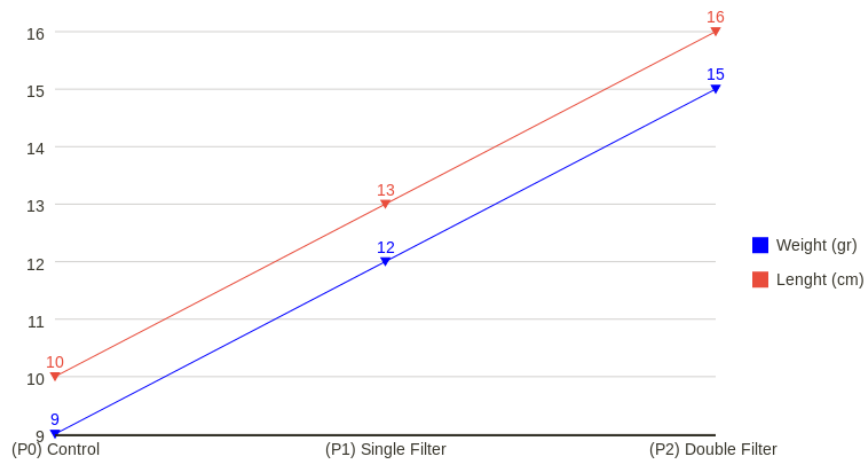


Figure 6. Weight and length measurement of giant prawns.

The highest average weight of giant prawns was found in the double filter treatment P2, namely 15 g, while the lowest average weight of giant prawns was found in P0, namely 9 g. This shows that the application of a double filter increases the weight of giant prawns (Figure 6). To determine the effect of giving treatment with different filter systems, ANOVA was carried out. Based on ANOVA for weight and length, the results were p value <0.05; it can be concluded that the average weight (Table 5) and length (Table 6) content in each treatment is significantly different.

Table 5

Results of ANOVA for the weight of giant prawns

Source of variation	Sum of squares	df	Mean square	F	Significance (p-value)
Between groups	54	2	27	21	0.002
Within groups	7.5	6	1.25		
Total	61.5	8			

Table 6

Results of ANOVA for the length of giant prawns

Source of variation	Sum of squares	df	Mean square	F	Significance (p-value)
Between groups	54	2	27	9	0.016
Within groups	18	6	3		
Total	72	8			

Discussion. The biofloc aquaponics was given eggplant cultivation plants, showing good growth results. Aquaculture plants and giant prawns in ponds show a mutualistic symbiotic relationship. The results of the study (Aini & Hana 2010) stated that NH_3 in the ponds during the research contained ammonia with an average concentration of 0.016 mg/L. This proved that the role of flocs in the ponds was being able to maintain NH_3 during the cultivation process. For this reason, in the combination of biofloc aquaponic, it is expected that excess nitrogen can be absorbed by plants almost entirely in the form of nitrate and ammonium. If plants absorb nearly 100% of N in the form of ammonium, it will increase protein availability.

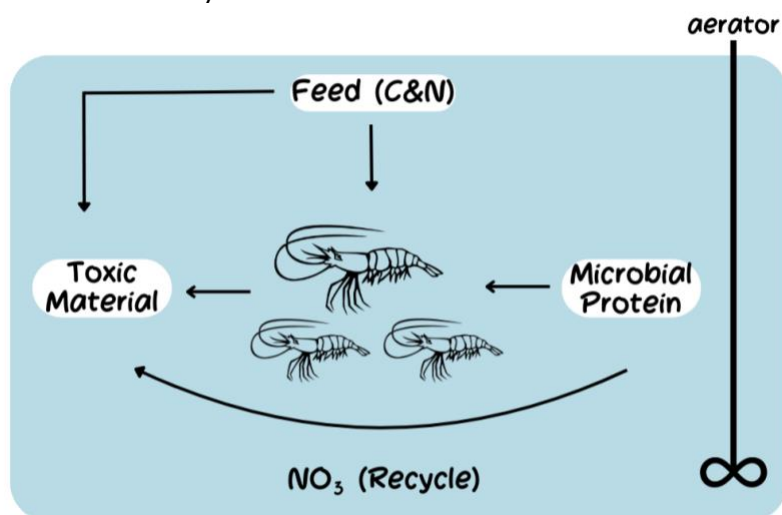


Figure 7. Nitrogen cycle in biofloc technology.

Cultivation techniques that are carried out by combining plant cultivation and fish farming are called aquaponics (Setijaningsih et al 2018). The use of aquatic plants in aquaponics, as part of a biological filter system, has proven effective in maintaining water clarity. Plants can absorb toxic substances such as ammonia and nitrates, which come from leftover feed and giant prawns' feces. In aquaponic technology, plants utilize nitrogen and phosphorus waste as fertilizer and can reduce dissolved N concentrations ranging from 60–99% and 50–90% dissolved P from aquaculture waste (Nugroho et al 2017). It can be seen that the NH_3 content is 0.01 mg L^{-1} (P2), which means the NH_3 content is below the quality standard. This condition can be expected due to the presence of bacteria that can break down waste from giant prawns, namely *Nitrosomonas*, which convert ammonia into nitrites, and nitrites are then converted into nitrates by *Nitrobacter* working optimally. This can be made possible by taking samples at mid-time to provide the opportunity for flocs to develop optimally so that the population can be maximized. According to the requirements of SNI 7550: 2009, the maximum limit for NH_3 levels for fish farming activities is $<0.02 \text{ mg L}^{-1}$. Assimilation by heterotrophic bacteria is considered an ideal route of NH_3 removal, as it allows for the complete recycling of waste nitrogen into fish protein through biofloc formation and the giant prawns feeding on biofloc (Figure 7).

According to (Rostika et al 2020), the decomposition of NH_3 by microbes can be carried out by a deamination process. Deamination is the process of breaking down proteins into amino acids; then, amino acids are broken down into NH_3 and several other substances by bacteria that produce the urease. Urease decomposes urea into ammonium carbonate, while ammonium carbonate easily decomposes into NH_3 , CO_2 , and H_2O . The urease enzyme is the only catalytic enzyme in hydrolyzing urea (Andriani et al 2019), added that the genus *Bacillus* is a microbe from a group of bacteria capable of synthesizing urease well in waters.

Nitrite is the result of oxidation from the first stage of the nitrification process. Nitrite is not used by plants but is broken down with the help of oxygen by *Nitrosomonas* and will soon be converted to nitrate if oxygen is sufficient. Based on the results of the

water quality analysis that has been carried out, it can be concluded that the nitrite level in P2 is 0.059 mg L^{-1} , the amount of this level is below the water quality standard of Government Regulation of the Republic of Indonesia No.82 of 2001. According to Anjar et al (2022), nitrite levels in fish-rearing catfish in aquaponic ponds ranged from $<1 \text{ mg L}^{-1}$. The low levels of nitrite are thought to be due to the relatively high levels of ammonia, although it has not exceeded quality standards, comparable to the availability of *Nitrosomonas*, which play a role in converting ammonia into nitrites, resulting in the nitrification process running optimally.

Nitrate is the main nutrient for plant growth processes. Nitrate is the result of oxidation in the second stage of the nitrification process. Nitrates (NO_3) are the main form of nitrogen in natural waters and are the main nutrient for plant growth. Nitrate is very soluble in water and is stable. Based on research results, the nitrate content is around 10 mg L^{-1} . A good value is around 20 mg . According to the water quality standard, Government Regulation of the Republic of Indonesia No.82 of 2001. The P2 had the lowest nitrate content; this was because the conversion of nitrite to nitrate in the nitrification process was only carried out by naturally occurring bacteria, so the process of converting nitrite to nitrate was not maximized. Meanwhile, the conversion of nitrite to nitrate can be increased by adding decomposing microorganisms. Plants in the aquaponic system provide a biofilter by utilizing nutrients derived from cultivation waste. Plant roots are also a medium for adding nitrifying bacteria, which help reduce NH_3 and provide the NO_3 that plants need. According to Nugroho et al (2017), nitrate is absorbed by plants through the roots as a natural fertilizer for growth. The development and growth of plants are strongly influenced by the nitrogen in the soil, but in an aquaponic system, nitrogen is sourced from the nitrate content in the pond water. Nitrogen absorbed by plants is essential for stimulating the growth of their organs. Dissolved Oxygen (DO) is an important parameter that affects shrimp and is vital for nitrifying bacteria, which are beneficial for converting shrimp waste into nutrients that can be utilized by plants. The concentration of dissolved oxygen is crucial for the survival of aquatic biota, including aquatic plants and animals. The greater the DO content value, the better the water quality. In aquaponic technology, the standard minimum dissolved oxygen parameter for plant growth is around 5 mg L^{-1} (Somerville 2014). Dissolved oxygen levels are around 6.3 mg L^{-1} , the highest at P2. Aquaponics can maintain DO conditions as a result of the solubility of small particles in water. The more DO content in the water, the better the condition of the pond. Oxygen is needed by plant roots to grow. According to (Sikawa & Yakupitiyage 2010), the optimum oxygen content for plant root respiration is 2.5 mg L^{-1} ; if it is below 0.16 mg L^{-1} , it causes the roots and leaves of the plants to wilt, so that nutrient absorption is not optimal. Integration between fish and plant cultivation in aquaponics can increase dissolved oxygen concentrations.

Biological Oxygen Demand (BOD) is a chemical parameter that functions to determine water quality. The BOD value is very important as an indicator of water quality. A high BOD content indicates a minimum amount of DO in the water. Based on the research results of the three treatments, it shows that the BOD value is greater than the value 3, which means it exceeds the SNI 7550:2009 quality standard. According to Azid et al (2020), these conditions will have an impact on the death of aquatic organisms such as fish due to a lack of DO (anoxia).

Chemical Oxygen Demand (COD) is the amount of oxygen required to oxidize organic matter by chemical oxidation. The COD content was 32 mg L^{-1} in each treatment, which could be interpreted as the lower the COD, the better the water quality. According to Harahap et al (2022), states that the COD value is high, resulting in poor oxygen content in water bodies, thereby disrupting aquatic ecosystems.

Based on Government Regulation of the Republic of Indonesia No.82 of 2001 (class II) water quality standards, a good pH for freshwater fish farming activities ranges from 6-9. The ideal pH for the life of freshwater biota is between 6.8 - 8.5. A very low pH causes the solubility of metals in water to increase, which is toxic to aquatic organisms, whereas a high pH can increase the concentration of ammonia in water, which is also toxic to aquatic organisms (Ramayanti & Amna 2019). Results of pH measurements in ponds. Water quality plays a very important role in the life of the shrimp that are kept.

Pond water is said to be good if it can support the life of the fish or shrimp that are kept. In general, the physical-chemical parameters of water that affect the life of fish or shrimp include temperature, hardness, dissolved oxygen, free carbon dioxide, pH, ammonia, and nitrite levels (Luh et al 2022). When in bad conditions, it can result in the death of cultivated shrimp (Pakaya et al 2022).

Based on Figure 3 shows that the highest carbohydrate, protein, and fat content was in the double filter treatment. Water from the biofloc pond that flows into the hydroponic circuit goes through two stages of filtering. The first filter is in the form of a filter basket containing bio-balls and zeolite stones, while the second filter is in the form of a large bucket containing bricks, zeolite stones, bioballs, and filter cotton as a filter media for water that is passed through it. The function of the filter is to increase oxygen levels, neutralize pH, breed plankton, absorb pollutants from dirt and leftover feed, and maintain pond water quality (Dewi & Ulfah 2022).

Hutagalung et al (2022) stated that biofloc could be formed if there are four components, namely carbon sources, organic matter from leftover feed and fish waste, decomposing bacteria, and oxygen availability. The formation of biofloc through stirring of organic matter by aeration so that it dissolves in the water column to stimulate the development of aerobic heterotrophic bacteria, which attach to organic particles, decompose organic matter, or take up C-organic, then absorb minerals such as ammonia, phosphate, and other nutrients in the water. So that the beneficial bacteria will reproduce well, these bacteria will form a consortium, and floc formation will occur. The result is better water quality and organic matter recycled into edible floc by fish.

The basic principle of biofloc is the retention of waste and its conversion into floc-forming bacteria. Increasing the C/N ratio through the addition of carbon increases the conversion of toxic inorganic nitrogen into biomass. Microbial biomass that forms floc together with other microorganisms is useful as a feed source for giant prawns. The rest will be lost and enter the culture system as ammonia and organic nitrogen in the feces and leftover feed. Microbial breakdown of organic matter causes the production of new microbes, as much as 40-60% of organic matter is metabolized by the bacteria (Avnimelech 2012).



Figure 8. Floc in the Pond.

An indicator of the success of biofloc forming in ponds can be seen from the color of the pond water (Figure 8). Successfully formed biofloc marked by the change in the color of the pool water to light brown (beige), greenish, with clumps that follow the current. If the pH of the water is measured, it will show a situation that tends to be neutral, namely at 7-7.8, with a slight increase in pH, which is 0.02-0.2, which can occur in the morning and evening. While in the pool, pH was measured at 6.9.

Furthermore, related to the nutritional value of biofloc, fails to form the first characteristic of foaming biofloc. The floc forms a foam, which indicates the presence of attached filamentous bacteria. These filamentous bacteria will reduce the floc content in the water. The second feature is that biofloc is too concentrated, so the water becomes dark. This will certainly interfere with the circulation of oxygen into the pond. The third

feature is that the water changes color to bluish green or red. This indicates that the pond has decreased the mass of biofloc due to seepage into the pond (Dewi & Ulfah 2022).

Biofloc is composed of several components: exopolysaccharides, floc-forming bacteria, and functional cycle bacteria. Exopolysaccharide is a polysaccharide compound produced by floc-forming bacteria. This exopolysaccharide is like glue, which is a place for the attachment of bacteria to become a biofloc. Not all bacteria can produce exopolysaccharides; certain bacteria can produce exopolysaccharides. Exopolysaccharide-producing bacteria are floc-forming bacteria and are referred to as Floc Forming Bacteria. Floccs that start to multiply are indicated by the presence of foam on the surface, and the color of the water in the rearing medium changes to yellow-brown. The size of biofloc is also strongly influenced by the amount of stirring, and the carbon source used is smaller than that of slower agitation of the water. The floc-forming bacteria will break down organic matter (proteins, carbohydrates, fats, etc.) that comes from leftover feed, fish waste, and dead bodies in the pond (Abrar et al 2019).

Absolute length growth is the difference in the total body length of a giant prawn at the end of rearing and the beginning of rearing. Based on Figure 5, it can be seen that the highest average absolute length of giant prawns was found in P2, which was 16 cm, and the lowest average absolute length was found in P0, which was 10 cm. This shows that the use of double filters affects the growth of giant prawns. To determine the effect of administration on the absolute length growth of giant prawns, ANOVA was performed. The results of ANOVA showed that the results of the study using filters had an effect on the length of giant prawns grown in environmentally friendly biofloc aquaponic columns. This can be seen in the F_{count} value of 9.0 and the F_{table} value of 5.14 with a significance of 0.05. Based on these results $F_{count} > F_{table}$, it can be concluded that the use of different filters affects the increase in length of giant prawns. Furthermore, to find out the difference in measurements measured for 3 months, a further test is needed (BNT Test). The results of the BNT test showed that P2 had a significantly different effect on P1 and P0. While the P1 and P0 had no significantly different effect from the P2. The growth in length of giant prawns during the study was in line with the growth in weight of the prawns, namely, the best growth was in P2, and the lowest was in P0.

According to Pakaya et al (2022), the growth rate of giant prawns is also influenced by internal factors related to the condition of the giant prawns themselves, such as genetics and physiological conditions as well as external factors, namely the environment in which the giant prawns live, such as the chemical properties of water, water temperature, metabolic waste, oxygen availability, and availability feed. (Mikdarullah & Nugraha 2021) stated that the fast giant prawn's growth can be accelerated by utilizing or providing feed with good nutrition and optimal dosage. The quality of the feed, which is still good, allows the giant prawns in each of these treatments to optimize the feed for their weight growth.

Biofloc aquaponic, besides being able to reduce inorganic nitrogen waste from leftover feed and manure, this system can also provide additional protein feed for farmed animals to increase growth and feed efficiency. According to (Salamah & Zulpikar 2020), fish can optimally utilize feed, both commercial feed and bacterial floccs. This means that heterotrophic bacteria form bacterial floccs, which are then eaten by giant prawns as natural food with high protein content to increase the length and wet weight of giant prawns. The high flocc value illustrates the ability of bacteria to form biofloc.

Bacteria capable of forming biofloc include *Bacillus subtilis*, *Bacillus cereus*, *Zooglea ramigera*, *Escherichia intermedia*, *Paracolobacterium aerogenoids*, *Flavobacterium*, *Pseudomonas alcaligenes*, *Sphaerotillus natans*, *Tetrad*, and *Tricoda sp.* Utilization of biofloc in fish farming for efficiency in aquaculture production costs because biofloc is used as a feed supplement (Dewi & Ulfah 2022). Furthermore, according to Ernawati and Rochmady (2017), *Bacillus* has extracellular enzymes that can help digestion and improve water quality through the decomposition and breakdown of organic matter in water. These bacteria function to increase the digestibility of fish feed so that it can spur fish growth. The work of *Bacillus* bacteria is to convert carbohydrates into lactic

acid, thereby producing endogenous enzymes to increase nutrient absorption, feed consumption, and growth, and inhibit the growth of pathogenic organisms.

According to Sukoco et al (2019), the growth in the body length of fish is influenced by the genetics of each individual and also by protein intake to support growth obtained from feed. To help utilize protein, the help of proteolytic microorganisms is needed, which can break down protein into polypeptides, oligopeptides, and amino acids, which can be directly utilized by the giant prawn's body to help its growth. According to Das et al (2020), giant prawn larvae given para probiotic *Lactobacillus plantarum* were able to increase immune parameters and protect against disease. Application of *Bacillus* sp. from previous studies reported being able to activate the host immune system (Mujeeb Rahiman et al 2010; Yuhana et al 2022).

Conclusions. The research results show that the use of filters is classified as efficient. There is an effect on the DO level in the addition of a filter, and there is no effect on the water quality, including NH₃, NO₂, NO₃, DO, BOD, COD, and pH. There is an effect on the nutritional value of carbohydrates, protein, and fat with the addition of a filter, and there is an effect on the growth of giant prawns seen from the weight and length of giant prawns with the addition of a filter.

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