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ARTICLE REVIEW OF MICROBIAL UTILIZATION IN FRESHWATER AQUACULTURE ACTIVITIES

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ABSTRACT

Microbes are very small organisms that have many benefits in the field of fisheries. This review article aims to find out the role of microbes in freshwater aquaculture activities, especially in maintaining the quality of aquatic bodies and the absorption of feed nutrients by fish. Based on the results of the review literature, it can be informed that the role of microbes in maintaining good water quality as a medium of freshwater aquaculture is to reduce ammonic levels through the degradation process using bioremediation technology. The role of microbes in improving quality is to condense complex compounds into simple compounds to increase the absorption of nutrients.
Keywords: Feed, Metabolism, Pests, Indicators, Probiotics

INTRODUCTION

Microbes are living things that can be used by humans for various things both in agriculture, animal husbandry, and fisheries. The use of these microbes is mainly aimed at improving food quality, producing antibodies, and others. One of the utilization of microorganisms in the field of fisheries is to increase the production of freshwater aquaculture.

Increased aquaculture production can be done in two ways. The first is the handling of the quality of aquaculture media water that remains good according to standards. The second is the use of feed that is easily digested and absorbed by fish. Various studies have been conducted and reported on the use of microbes to improve the quality of aquaculture bodies and improve the quality of feed to get maximum fish growth. The purpose of this article review is to find out the role of microbes in freshwater aquaculture activities, especially in maintaining the quality of aquatic bodies and absorbers.

The Role of Microbes in Improving Water Quality for Freshwater Aquaculture

One of the factors that play a role in the success of freshwater aquaculture is the quality of the water in which the fish is cultivated. Water quality that is qualified for fish growth should always be maintained for a period as long as the fish is cultivated. A common water quality parameter used for fish farming activities is the presence of ammonia in these aquatic bodies. The source of ammonia in aquatic bodies can come from the rest of the feed, the rest of the metabolism of cultivated fish, and the garbage that enters the body of the waters.

The presence of ammonic in the body of the waters becomes important to do. High ammonia content exceeding the limit of tolerance in aquatic bodies will cause a slowdown in growth and even death in the fish that is coveted. Ammonia compounds in aquatic bodies can be lowered by decomposing these compounds into nitrogen gas or nitrogen oxides. The decomposition process can be done by utilizing the activity of microorganisms. An example of its technological application in bioremediation.

Bioremediation is a remediation activity that utilizes microbial metabolism to eliminate contaminants. Bioremediation can be categorized into ex-situ bioremediation (outside the original ecosystem) or in situ (within the original ecosystem). Some examples of bioremediation methods include bioreactor, bioleaching, landfarming, composting, bioventing, biostimulation, bioaugmentation, hemofiltration, and phytoremediation (Sharma, 2012).

Perpetuo et al., (2011) Bioremediation is a stage that utilizes microbes and enzymes to eliminate and/or reduce pollutant factors from an ecosystem. The utilization of microbial metabolic capabilities in degrading and eliminating environmental pollution produces safe and more economical solutions than other physicochemical methods. Vidali (2001) also explained that bioremediation is an option that provides a probability to eliminate or disable various diseases through the use of natural biological activities that tend to be cheap, low-tech methods, acceptable to the general public, and can be implemented periodically.

In its application in the fish farming sector, various types of microbes have been observed to be made into remediation agents of the aquaculture ecosystem. Table 1, are some types of microbes and their role in the process of bioremediation. (Menn et al., 2008)

Table 1. Genetic Engineering for Biodegradation of Contaminants

Microba	Modification	Contaminants	Reference
Pseudomonassp.B13	Pathway	Mono/Dichlorobenzoates	Reineke andKnackmuss,1979, 1980
P.putida	Pathway	4-Ethylbenzoate	Ramos *et al*., 1987
P.putida KT2442	Pathway	Toluene, Benzoate	Panke *et al*., 1998
Pseudomonassp.FR1	Pathway	Chloro-methyl benzoates	Rojo *et al*.,1987
C.testosteroniVP44	Substrate specificity	o-,p-mono chlorobiphenyls	Hrywna *et al*., 1999
Pseudomonassp.LB 400	Substrate specificity	PCB	Erickson and Mondello, 1993
E. coli JM109	Substrate	PCB, Benzene,	Kumammru
(pSHF1003)	specificity	Toluene	*et al*., 1998
P.pseudoalcaligenes KF707-D2	Substrate specificity	TCE, Toluene, Benzene	Suyama *et al*., 1996
E. coli FM5/ pKY287	Regulation	TCE, Toluene	Winter et al., 1989

In the field of aquaculture, there are several types of microbes that have been studied to be played as remediation in the field of cultivation. According to Moriarty *et al*., (2005), group Genus *Bacillus* like *B. subtilis* and *B. licheniformis* is widely used for aquatic field probiotic bacteria.

Several studies have reported successful bioremediation using probiotic bacteria. Examples of the use of probiotic bacteria in the cultivation of eel fish that can improve the survival of these fish, as found in Table 2.

Table 2. Survival of eel fish for 5 weeks at each treatment of probiotic microorganisms in maintenance media

Treatment	Survival
0 ml/L	9.1 ± 0.02 %
5 ml/L	32.0 ± 0.06 %
10 ml/L	42.3 ± 0.01 %
15 ml/L	48.3 ± 0.01 %

(Mattjik and Sumartajaya, 2000)

Table 2 shows the provision of probiotics that increasingly cause the survival of sided fish is getting higher. This means that the probiotic component is a microbe that can serve as bioremediation in the maintenance media of test eel fish. Probiotic components such as bioremediation can utilize the rest of the metabolism in water so that the water quality conditions of the test eel maintenance media remain optimal as found in Table 3.

Table 3. Water quality of eel fish farming media at each treatment for 5 weeks

Water quality parameters	Treatment			
	A	B	C	D
Temperature (°C)	29 - 30	29 - 31	30 - 31	30 – 31
Oxygen (ppm)	2,3 - 4,2	2,6 - 4,4	3,6 - 5,3	3,6 - 5,8
pH	7,1 - 8,0	7,2 - 8,0	7,1 - 8,0	7,2 - 8,0
Ammonia (ppm)	0,2 -0,3	0,1 - 0,2	0,1 – 0,2	0,01-0,02

(Mattjik and Sumartajaya, 2000)

The probiotic bacteria used in the study were *Azotobacter, Bacillus,* and *Pseudomonas.* This type of bacteria is a component of "bioremediation" to reduce toxic gases in the water maintenance media, especially nitrite, nitrate, and ammonia compounds. (Boyd *et.al.*1998). Other research related to the decrease in ammonia levels in catfish maintenance media using bacterial agents through biofloc technology has been reported by Kristian Dediyanto, dkk (2017). The bacteria used in the biofloces are *Bacillus sp*.

The results showed that the maintenance of fish with a biofloc system can maintain ammonia levels in the maintenance media remains low compared to non-biofloc as found in Figure 1.

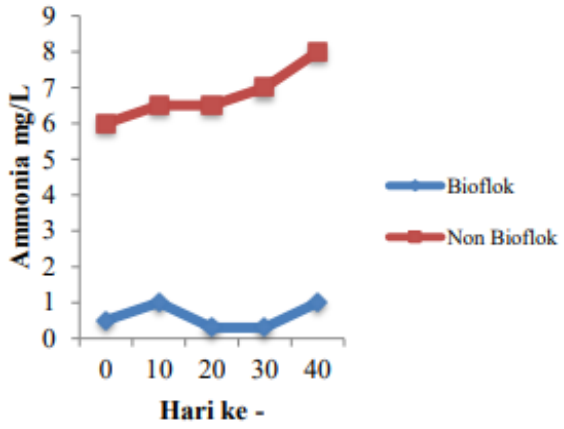

Figure 1. Ammonia levels in catfish maintenance media between biofloc and non-biofloc systems

Using *Bacillus sp* can improve water quality by balancing microbial populations and reducing the number of pathogens and simultaneously reducing the use of chemical compounds and increasing the growth of aquatic animals (Irianto, 2003). *Bacillus sp* including cabbage bacteria have high life resistance compared to other pathogenic bacteria and are easier to grow and isolate.

The Role of Microbes in Improving Feed Digestibility

The largest business capital in fish farming activities is feed. Feed costs in aquaculture activities can reach 60% of the total capital. Feed also has an important role in maximizing the yield of cultivated products through the growth rate of the fish it cultivates. Good-quality feed will be able to accelerate the growth of fish so that maximum cultivation production can be obtained. According to Sugih (2005), feeding with less than optimal

quality and quantity resulted in the feed being inefficient because the feed provided was not able to digest properly.

One of the efforts that can be made to reduce feed costs is to increase the efficiency of feed use, among others, by utilizing microbes. Microbes such as probiotics can break down or break down long chains of carbohydrates, proteins, and fats in a given feed ingredient. This happens because of the presence of special enzymes owned by microbes to break these bonds. These enzymes are usually not owned by fish and other aquatic creatures although there is a limited quantity and quality. The breakdown of these complex molecule molecules into simple molecules will facilitate their continued digestion and absorption in the digestive tract of fish. On the other hand, microbes benefit in the form of energy obtained from the overhaul of these complex molecules. The use of microbes in feed can be probiotics that live in the digestive tract of fish as well as predigest to simplify feed raw materials before being given a fish.

Various studies have been conducted related to the use of microbes in increasing fish growth. Examples of the addition of probiotic microbacter alfalfa 11 to feed for siamese catfish cultivation were carried out by Supriyan dkk (2020). The results showed that the administration of probiotics microbacter alfalfa 11 as 5 ml/kg feed provides better growth results for catfish compared to those that probiotics do not add. Catfish whose feed plus probiotics experience an average weight gain of 7,85 grams while those that are not added probiotics as much as 3,94 grams.

Other research was also reported by Chimawati dkk (2018), that the addition of probiotics to milkfish feed can increase the daily growth rate by 1.958±0.02%/day While those who do not add probiotics are only as large as 1.573±0.02% /day. Probiotics used are made up of microbes. Probiotics used are made up of microbes Saccharomyces cerevisiae, Aspergillus oryzae, Lactobacillus acidophilus, Bacillus subtilis, Rhodopseudomonas, Actinomycetes, and Nitrobacter.

Based on the results of these studies show that the addition of probiotic microbes has a good impact on the growth rate of fish. The role of microbes, in this case, includes increasing the digestibility of fish, namely stimulating the production of endogenous enzymes to increase nutrient absorption, feed consumption, growth, and blocking pathogenic organisms.

CONCLUSION

Based on the results of the review literature, it can be informed that the role of microbes in maintaining good water quality as a medium of freshwater aquaculture is to reduce ammonic levels through the degradation process using bioremediation technology. The role of microbes in improving quality is to condense complex compounds into simple compounds to increase the absorption of nutrients.

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