Research on a Microecological Agent for Aquatic Environment Management in Aquaculture

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Abstract: The deterioration of aquaculture environment and diseases have led to the water quality of aquaculture water bodies being not only affected by natural factors, but also by human and biological factors. Therefore, aquaculture operators must pay attention to the improvement of water quality. This article studies the aquaculture water environment through a microecological preparation. Microecological agents refer to the biological agents made by the cooperation of beneficial strains from the normal microbiota through targeted screening based on the theory of microecology, which are used to adjust the micro Balance of nature of aquatic animals' intestines, inhibit the growth of pathogenic bacteria, promote the absorption of nutrients and improve the water quality of aquaculture waters. The addition amount of probiotics is required to make beneficial bacteria the dominant bacteria in order to exert their maximum effect in aquaculture water bodies. Therefore, if water is changed or disinfectants are used in the middle, the dosage for the first use should be added after the water is changed or a few days after the use of disinfectants. Among them, microecological agents are non-toxic, free of side effects, residual pollution, and resistance, which can effectively improve the breeding ecological environment, improve the immunity of breeding animals, reduce the occurrence of diseases, improve health, promote growth, and maintain the Balance of nature of breeding.

1. Introduction

With the continuous expansion of aquaculture scale, especially the excessive use of fishery drugs and bait, it may lead to the enrichment of nitrogen, phosphorus and other elements in aquaculture water environment, the proliferation of harmful microorganisms, and the imbalance of aquaculture ecological environment, thus affecting the growth speed and quality of aquaculture objects. The deterioration of aquaculture environment and diseases cause the water quality in aquaculture water to be affected not only by natural factors but also by human factors and biological factors, such as fertilization, feeding, washing, application of drugs, drainage and irrigation, feces and secretions of aquaculture animals, and the reproduction, growth and residual waste of aquatic organisms [1]. Therefore, the aquaculture industry must pay attention to the improvement of water quality. In this paper, a microecological preparation was used to study the aquaculture water environment. Microecological preparation refers to a biological preparation which is made up of beneficial strains in normal microbial groups through directional screening by using microecological theory, and is used to adjust the intestinal microecological balance of aquatic animals, inhibit the growth of pathogenic bacteria, promote the absorption of nutrients and improve the water quality of aquaculture waters [2]. Microecological agents use biotechnology to adjust the microenvironment, so as to optimize the microenvironment and improve the macro-ecological environment. In a narrow sense, microecological preparations are often considered as "microbial preparations". In fact, microecological preparations are the general name of all kinds of products that can improve the microecological environment. According to the viewpoint of sustainable development, establishing a clean aquaculture model is an important means to maintain the healthy and stable development of aquaculture [3]. Microecological preparation is a new product developed with beneficial bacteria directly separated from nature as the main body, which has no residue and side effects, and is of great significance to improving aquaculture environment and healthy aquaculture [4]. Through the

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study of microecology, people realize that there are a large number of beneficial microbial flora in water. Using these beneficial microbial flora can not only improve the aquaculture ecological environment and prevent fish, shrimp and crab diseases, but also have the advantages of small investment, large income, no pollution and no residue, which is accepted by more and more aquaculture owners [5]. When microecological agents are directly added to the culture pond, attention should be paid to whether the environment is suitable for the survival and reproduction of beneficial bacteria. If chemicals such as antibiotics are added to the water, the effect of microecological agents will be reduced. The addition of microecological agents requires that beneficial bacteria become dominant bacteria, which can play the greatest role in aquaculture water. Therefore, if water is changed and disinfectants are used in the middle, the first dose should be supplemented after changing water or using disinfectants for a few days [6]. Among them, microecological preparation has no toxicity, no side effects, no residual pollution and no resistance, which can effectively improve the breeding ecological environment, improve the immune ability of breeding animals, reduce the occurrence of diseases, improve health, promote growth and maintain the breeding ecological balance.

2. The role of probiotics in aquaculture water environment

2.1. Improve body metabolism

The microbial communities in the animal digestive tract mainly include Lactobacillus, Bifidobacterium, Bacillus, Bacteroides, etc. The existence of these microbial communities and their balance with the host ensure normal metabolism of the host, provide rich nutrients such as vitamins for the growth and development of the body, and promote the effective synthesis and absorption of various amino acids, vitamins, and other nutrients in the digestive tract, thereby promoting growth [7]. As shown in Figure 1, organic matter can be degraded and converted into nutrients and growth factors required for algal growth, and can promote algal growth. Some bacteria can even dissolve toxic algae or have the potential to control algal blooms. After using probiotics, harmful cyanobacteria in seawater shrimp ponds decreased, beneficial algae increased, and the number of Phytoplankton steadily increased with the increase of test time; At the later stage of the experiment, the number of Zooplankton also showed a steady increase trend [8].

Figure 1 Aquaculture Mode

Due to the inability of photosynthetic bacteria to decompose macromolecular organic matter in aquaculture water bodies, such as residual bait, excrement, and plankton residues, the improvement effect on sediment with severe organic matter pollution is not significant. On the other hand, photosynthetic bacteria contain abundant proteins, vitamins, and various immune promoting factors. Therefore, as a feed additive, they can improve the digestion and absorption rate of aquatic animals, enhance the immune function of the body, and enhance the stress response of the body.

2.2. Improve water quality

Bacteria, fungi and microalgae in microecological preparations are the main members of biodegradation, which can remove organic wastes and improve the water environment. Putting EM-active microbial special fertilizer into fish ponds can increase dissolved oxygen, reduce nitrite, ammonia nitrogen and feed coefficient. Using microecological agents made of Rhodotorula glutinis, bdellovibrio bacteriophagus and rhodopseudomonas sphaeroides in shrimp breeding in China can obviously purify the water quality. It can effectively improve the water quality and prevent and control the occurrence of diseases by regularly and continuously putting microecological live bacteria preparations into shrimp and crab polyculture ponds [9]. Photosynthetic bacteria have unique photosynthesis, which can utilize light energy more widely than algae, can directly consume and utilize organic matter and ammonia nitrogen in water, and can also utilize hydrogen sulfide, and can remove pollutants such as nitrite in water through denitrification. Although it does not produce oxygen, it can increase dissolved oxygen in water by lowering water [10].

2.3. Inhibition of pathogenic bacteria

Beneficial bacteria produce antibacterial substances and compete with harmful bacteria for Ecological niche, so as to inhibit pathogenic microorganisms, improve the Internal environment of animals' intestines and the external environment of water bodies, and protect animals from the invasion of pathogenic bacteria. Beneficial bacteria are also good immune activators, which can effectively enhance the activity of interferon and macrophages, stimulate the body's immune function by producing non-specific immune regulatory factors, and enhance the body's immunity [11]. At present, there are two main production processes for probiotics: solid-state fermentation and liquid fermentation. The solid fermentation method has a simple production process and low investment, but it is prone to contamination by miscellaneous bacteria, difficult to control the bacterial content, and unstable product quality. Currently, most of the microecological preparation products in China use this production method. The liquid fermentation method has the characteristics of full process control, easy Aseptic technique, easy control of bacterial content, and stable product quality, but its technical level and investment are high. Solid preparations mainly come in two forms: powder and tablet. In aquaculture, powder is the main form. Powder has the characteristics of convenient transportation, carrying, and storage. It can be mixed with various immune enhancers used in aquaculture to make aquatic animal disease prevention and growth promoting additives, as shown in Table 1.

Table 1 Quality Requirements for Solid Powder and Liquid Microbial Preparations

Category	Quality requirement
Solid powder	1. The powder should be dry, loose, evenly mixed, with consistent color and good fluidity. 2. High purity and stable quantity of bacterial strains
Liquid formulations	1. The ratio and bacterial content of each strain must be accurate; Oral preparations should not have odors that affect the feeding of farmed animals; It should have a certain ability to prevent corruption, and there should be no contamination of miscellaneous bacteria during storage and use. 2. The packaging container should be suitable, convenient to carry and use

After the microecological preparation adapts to the environment, by promoting or inhibiting the growth and reproduction of some bacteria, it may have a significant impact on the bacterial community in the culture environment and improve the culture environment. Bacillus can quickly decompose organic matter such as residual bait, excrement and animal residues in water, obviously reduce the eutrophication of aquaculture water and purify the water quality. Bacillus belongs to strict aerobic bacteria, which consumes oxygen after entering the intestine, promotes the proliferation of beneficial bacteria such as Bifidobacterium and lactic acid bacteria, and inhibits the growth of aerobic pathogenic bacteria [12]. At present, the application of microecological agents in aquaculture at home and abroad has received good results. Relevant research shows that microecological agents can promote the growth and development of aquatic animals such as fish,

shrimp and crab.

3. Several commonly used microecological agents and their uses

3.1. Photosynthetic bacteria

The use of microecological agents is to strengthen the decomposition of excess nutrients and improve the decomposition ability of nutrients in nature, so that nutrients that were originally beyond the carrying capacity of the environment can be decomposed into inorganic small molecular substances that have no pollution to the environment in a relatively short time. The beneficial bacteria in microecological preparations are screened in aquatic animals. When microecological preparations are used, the beneficial bacteria in aquatic animals are supplemented and occupy an absolute advantage in quantity, thus repelling pathogenic bacteria and preventing diseases. Photosynthetic bacteria is the most widely used and used microecological preparation at present. Pollution is often caused by human destruction of some links in the cycle, which is beyond the scope that nature can carry, thus leading to the accumulation of one or more substances and forming pollution. In water pollution, a lot of untreated or substandard sewage is often discharged into natural water bodies at will, resulting in a sudden increase in organic matter in natural water bodies beyond the decomposition ability of decomposers existing in nature itself, thus breaking the balance and leading to a series of environmental pollution problems. The use of photosynthetic bacteria can be greatly improved. Photosynthetic bacteria belong to the order Rhodospirillum, which is divided into 4 families, 2 genera and more than 80 species, including Rhodospirillum, Chromobacterium, Chlorobacteriaceae and Green Filamentidae, among which Rhodospirillum is mainly used in aquaculture.

3.2. Yeast

The normal microbial flora in aquatic animals is dominated by anaerobic bacteria, accounting for 99%, while aerobic bacteria and Facultative anaerobic organism only account for 1%. After some aerobic beneficial bacteria enter the body, they consume a large amount of oxygen in the body, helping the growth of anaerobic bacteria and inhibiting the growth of aerobic pathogenic bacteria. When the water quality deteriorates, use can achieve preventive effects. Meanwhile, yeast belongs to living bacteria and cannot be used together with antibiotics. Therefore, probiotics can only be used at least 7 days after the application of antibiotics to treat diseases. Yeast cells contain a variety of Essential amino acid and Essential fatty acid, rich vitamins, minerals, and a variety of immune active substances of Digestive enzyme. Special nutrients make up for the nutritional deficiencies of conventional diets and are mainly used as feed additives. At present, yeast used in aquaculture mainly includes Saccharomyces cerevisiae, Candida, marine yeast, and feed yeast. By utilizing modern biotechnology, various environmental governance solutions have been provided. For example, the use of yeast in high organic solids wastewater enables the rapid decomposition of organics, and the Nitrifying bacteria used in high nitrogen wastewater can specifically decompose the combined nitrogen in the water into free nitrogen. In aquaculture water, some microecological agents represented by Bacillus subtilis can improve the water environment, but also have a certain health care effect on aquatic breeding objects.

3.3. Bacillus

Due to the high requirements for strain screening and production process of probiotics, it is necessary to choose Bacillus subtilis produced by formal production enterprises to ensure the purity, concentration, and stability of probiotics. Bacillus is a kind of aerobic bacteria, which can form Endospore under adverse circumstances. Therefore, the microecological preparation made of Bacillus has the advantages of high stability, strong stress resistance, high temperature resistance, acid and alkali resistance, processing resistance, easy storage and transportation. After safety verification, it has gradually been applied to microecological preparations. Bacillus often has characteristics such as strong targeting, decomposition ability, and adaptability, and can play a

crucial role in environmental governance. The concentration ratio of Bacillus subtilis, reasonable combination, and making them into composite probiotics, combined with debugging and using concentrations, regulating certain physical and chemical factors in the aquaculture water environment, may fully utilize the functions of various bacteria and have strong comprehensive treatment ability for aquaculture water bodies.

4. Conclusions

Today, people pay more and more attention to environmental quality, sustainability of production and life and environmental compatibility. Biological management, safety management and balance restoration of aquaculture water environment are inevitable trends in the future, and comprehensive ecological management is also the only way to repair the damaged ecological balance. Through the study of microecology, people realize that there are a large number of beneficial microbial flora in water. Using these beneficial microbial flora can not only improve the aquaculture ecological environment and prevent fish, shrimp and crab diseases, but also have the advantages of small investment, large income, no pollution and no residue, which is accepted by more and more aquaculture owners. Microecological preparation has the characteristics of wide range of action, no toxic and side effects, no residue and no resistance, which effectively avoids the insecurity caused by the use of antibiotics in aquaculture and provides a strong guarantee for the production of pollution-free aquatic animal products. Rotifers, cladocera, copepods, etc. in the water will eat live bacteria in microecological preparations, so it is necessary to reduce these populations before using them when spraying them all over the pool. At present, the species of bacteria suitable for microecological preparations can not fully meet the application needs, so the relationship between various bacteria is deeply studied in order to develop excellent microecological preparations. In a word, microecological preparations have broad application prospects, and their future development will surely advance by leaps and bounds.

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