THE ROLE OF PROBIOTICS IN REDUCING ENVIRONMENTAL POLLUTION

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Shrimp aquaculture represents an attempt to duplicate estuarine conditions in a terrestrial environment. Shrimp are typically raised at high densities in small areas, requiring artificial inputs such as feed, fertilizers, and drugs. These inputs create pollution in aquaculture ponds in the form of unutilized feed, fecal matter, and dead algae, among others. This organic load settles at the bottom of the pond. When the crop is harvested, pond effluents are emptied, which results in the discharge of large quantities of wastewater into nearby water sources, posing a threat to coastal ecosystems. Coastal areas are fragile and important environments, and preservation of these areas should be taken into consideration when planning aquaculture development.

Some of the steps already taken to create sustainable aquaculture practices include farm-licensing, establishing codes of conduct, and making use of hazard analysis and critical control points. However, outbreaks of disease are a major concern for shrimp farmers, and the methods employed against these outbreaks are often environmentally harmful. The antibiotics and chemicals used to combat outbreaks of disease are a significant source of aquaculture pollution. One possible alternative is the use of probiotics. Probiotics offer an environmentally friendly method of creating disease-free aquaculture operations.

As defined by the United Nations Food and Agriculture Organization and the World Health Organization, probiotics are "live microorganisms which when administered in adequate amounts confer a health benefit on the host."[i] Another common description of probiotics is "A live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance."[ii] Probiotics are non-pathogenic and non-toxic. The application of probiotics diminishes the growth of pathogens and enhances the growth of beneficial bacteria, leading to improved water quality and healthier shrimp.

Probiotics colonize the gastrointestinal tract. In aquatic animals, the intestinal microflora change rapidly due to the constant influx of microbes from food and water, creating a transient microbial community. This transience makes it possible to use live microbial preparations in ponds. It can therefore be difficult to distinguish between probiotics and bioremediators in aquaculture.[iii]

The first probiotic discovered was *Lactobacillus* sp., the bacteria that produces lactic acid. Many other probiotics have since been found. For use in aquaculture, probiotics are mixed with feed using a binding substance such as egg or cod liver oil. A number of commercial probiotics are currently available, including Aqualact, Probe-La, Lacto-sacc Epicin, Biogreen, Environ, Wunopuo-15, and Epizyme.[iv] Probiotics can be used to control pathogenic bacteria and to promote the growth of the organisms being raised. They do not have any undesirable side effects when administered to aquatic organisms, but more research needs to be done to ensure food and environmental safety.

Li Hui-Rong, *et al*., studied the use of probiotics in raising *P. japonicus*. The application of Alken Clear-Flo 1200 bacteria in an aquaculture pond reduced the level of ammonia after one week relative to ammonia levels in a pond left untreated. There was no effect on the shrimp.

Thus it appears that the addition of probiotics affected the accumulation and removal rates of ammonia without having any harmful effect on the product being raised.[v]

To create an effective management plan for the sustainable development of aquaculture in coastal areas, it is necessary to assess the sources of pollution and their impact on the environment. Probiotics are becoming an important feed supplement in the effort to prevent disease in shrimp aquaculture without causing environmental degradation.[vi]

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