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POSTBIOTICS: THE NEXT GENERATION OF HEALTH PROMOTERS IN AQUACULTURE

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Aquaculture plays a crucial role in global food security by providing high-quality animal protein and supporting the livelihoods of millions of people. However, disease outbreaks continue to be one of the major constraints to sustainable aquaculture production. Traditionally, antibiotics have been used to control bacterial diseases in fish and shrimp farming. Excessive and indiscriminate use of antibiotics has led to concerns about antimicrobial resistance, environmental contamination, and food safety.

In recent years, researchers have focused on developing sustainable alternatives to antibiotics. Among these innovations, postbiotics have emerged as a promising strategy for improving aquatic animal health. Postbiotics offer many of the benefits associated with probiotics while overcoming some of their limitations, making them an attractive option for modern aquaculture.

What Are Postbiotics?

Postbiotics are preparations of non-living microorganisms and their bioactive metabolites that provide health benefits to the host. They are produced during the fermentation process of beneficial bacteria and may contain organic acids, bacteriocins, enzymes, peptides, exopolysaccharides, vitamins, and microbial cell components.

Unlike probiotics, postbiotics do not contain live microorganisms. Therefore, they are more stable during feed processing, storage, and transportation while still retaining their biological activity.

Importance of Postbiotics in Aquatic Animal Health

Enhancing Disease Resistance

Disease outbreaks caused by bacterial pathogens such as *Vibrio*, *Aeromonas*, and *Photobacterium* species result in significant economic losses in aquaculture. Postbiotics contain antimicrobial compounds that inhibit the growth of harmful bacteria and reduce pathogen colonization in the digestive tract.

Several studies have demonstrated that postbiotic supplementation can improve survival rates in fish and shrimp challenged with bacterial pathogens.

Strengthening Immune Responses

The immune system serves as the first line of defense against infectious diseases. Postbiotics stimulate innate immune responses by increasing phagocytic activity, lysozyme production, antioxidant enzyme activity, and the expression of immune-related genes.

Enhanced immunity enables aquatic animals to better resist infections and recover more rapidly from environmental stressors.

Improving Gut Health

The gastrointestinal tract is essential for digestion, nutrient absorption, and disease resistance. Postbiotics help maintain intestinal integrity and support the growth of beneficial microbial communities. A healthy gut environment improves feed utilization and overall animal performance.

Promoting Growth Performance

Healthy fish and shrimp exhibit better growth rates and feed conversion efficiency. By improving nutrient digestion and absorption, postbiotics contribute to increased weight gain and productivity. Several feeding trials have reported improved growth performance in aquaculture species receiving postbiotic-supplemented diets.

Mitigating Environmental Stress

Aquatic animals are frequently exposed to stress caused by temperature fluctuations, salinity changes, handling, transportation, and poor water quality. Postbiotics possess antioxidant properties that help reduce oxidative stress and improve the resilience of fish and shrimp under challenging environmental conditions.

Advantages

- High stability during feed manufacturing.
- Longer shelf life compared to live probiotics.
- No risk of introducing live microorganisms into culture systems.
- Easier storage and transportation.
- Reduced concerns regarding the transfer of antimicrobial resistance genes.
- Consistent efficacy under varying environmental conditions.

Applications in Aquaculture

Postbiotics can be incorporated into:

- Fish and shrimp feeds
- Hatchery production systems
- Biofloc technology systems
- Recirculating aquaculture systems (RAS)
- Functional aquafeeds

Their use has been associated with improved survival, enhanced immunity, better feed conversion ratios, and reduced disease incidence in several cultured species.

Future Prospects

The growing demand for sustainable aquaculture practices is expected to drive increased adoption of postbiotic technologies. Advances in microbiology, biotechnology, and feed science are facilitating the development of species-specific postbiotic products with enhanced efficacy.

Future research is likely to focus on identifying novel microbial metabolites, understanding mechanisms of action, and optimizing application methods for different aquaculture systems.

Conclusion

Postbiotics represent an innovative and sustainable approach to aquatic animal health management. Their ability to enhance immunity, improve gut health, promote growth, and reduce disease susceptibility makes them a promising alternative to antibiotics. As aquaculture moves toward environmentally responsible production practices, postbiotics are expected to play an increasingly important role in ensuring healthy fish and shrimp production while supporting the long-term sustainability of the industry.

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