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Perspective

Modernizing Aquaculture through Recirculating Systems

Diponkor Pandit*

Department of Fishery Resources, Khulna Agricultural University, Khulna, Bangladesh

INTRODUCTION

Aquaculture, the farming of fish and other aquatic organisms, has become one of the fastest-growing sectors in global food production. As the demand for seafood increases, so does the need for more efficient, sustainable and environmentally friendly aquaculture practices. One of the most promising innovations in this field is the development of Recirculating Aquaculture Systems (RAS). These systems offer a way to farm fish with minimal environmental impact while maximizing productivity, making them a cornerstone of modernizing aquaculture.

DESCRIPTION

What is recirculating aquaculture?

Recirculating aquaculture systems are closed-loop systems designed to grow fish and other aquatic organisms in a controlled environment. Unlike traditional open-water fish farming, where fish are raised in large ponds or cages, RAS maintains water quality by filtering and reusing the water continuously. Water is pumped from fish tanks through a series of filters and biofiltration processes to remove waste products, such as ammonia and solid particles, before being returned to the tanks. This closed-loop circulation minimizes water waste and ensures that the environment remains stable and optimal for fish growth.

Advantages of recirculating aquaculture systems

Water conservation: One of the most significant advantages of RAS is its water efficiency. Traditional aquaculture systems, especially open-water fish farms, can waste large amounts of water through evaporation, runoff and the need for regular water exchanges. In contrast, RAS can reduce water usage by up to 99%, as the water is continuously recycled and reused within the system. This makes RAS an ideal solution for farming in water-scarce regions or areas where freshwater resources are limited.

Environmental sustainability: In traditional aquaculture, the release of fish waste, chemicals and excess feed into the surrounding environment can lead to pollution, affecting water quality and local ecosystems. RAS minimizes this impact by keeping waste products contained within the system and treating them before discharge. This reduces the potential for nutrient runoff into surrounding water bodies, preserving biodiversity and preventing pollution. Additionally, the system's ability to reuse water makes RAS a far more sustainable alternative to traditional methods.

Increased control and productivity: With RAS, aquaculture farmers have precise control over the growing environment, including water temperature, pH, oxygen levels and salinity. This allows for optimal conditions for fish growth, leading to faster growth rates and higher survival rates. RAS systems can also be used to cultivate a wide variety of species, from freshwater fish like tilapia and trout to saltwater species such as salmon and shrimp. By controlling the environment, farmers can ensure year-round production, regardless of seasonal changes or external weather conditions.

Disease management: The controlled environment of RAS helps reduce the risk of diseases that can spread in open-water farming systems. With water quality carefully monitored and waste tightly managed, the likelihood of disease outbreaks is significantly lowered. Furthermore, because the water is continually filtered, harmful pathogens can be removed or treated more effectively than in traditional aquaculture systems. This leads to healthier fish stocks and reduces the need for antibiotics or other chemical treatments.

Reduced land use: Traditional fish farming often requires large, open areas of land, sometimes in environmentally sensitive coastal or wetland areas. Recirculating aquaculture systems, however, can be set up in smaller, urban environments, reducing the need for expansive land use. RAS facilities can be established in warehouses, buildings or even on rooftops, making it possible to farm fish locally, near population centers. This urban aquaculture approach minimizes transportation costs and supports local food security.

Correspondence to: Diponkor Pandit, Department of Fishery Resources, Khulna Agricultural University, Khulna, Bangladesh; E-mail: dpandit@gmail.com

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Challenges of recirculating aquaculture systems

Despite the many benefits, there are challenges associated with RAS. The initial capital investment required to set up a recirculating system can be high, especially for large-scale operations. Additionally, the technology requires skilled operators and regular maintenance to ensure proper functioning. Energy consumption, particularly for water pumps and filtration systems, is another concern, although advancements in energy-efficient technologies are helping mitigate this issue.

The future of aquaculture with RAS

As global populations continue to grow and the demand for seafood increases, the need for sustainable, efficient aquaculture solutions will only rise. Recirculating aquaculture systems represent a major step toward meeting these needs, offering a way to produce seafood in an environmentally responsible manner. With continued technological advancements, cost reductions and widespread adoption, RAS could become the dominant method of aquaculture in the coming decades.

CONCLUSION

In conclusion, recirculating aquaculture systems are modernizing the aquaculture industry by improving sustainability, increasing water efficiency and enhancing disease control. These systems offer a promising solution to the challenges faced by traditional aquaculture, making them a crucial component of the future of sustainable seafood production. As RAS technology continues to evolve, it has the potential to revolutionize how we farm fish, contributing to a more secure and sustainable global food system.