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Impact of Biofloc Systems on Nutrient Use and Wastewater Management

Kaliyamurthi Venkatachalam[1*] and Ambika Binesh[2]

[1]Dept. of Basic Sciences (Biochemistry), [2]Dept. of Basic Sciences (Biotechnology), Institute of Fisheries Post Graduate Studies, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, OMR Campus, Vaniyanchavadi, Chennai, Tamil Nadu (603 103), India

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Corresponding Author

Kaliyamurthi Venkatachalam

e-mail: kaliyamurthi@tnfu.ac.in

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E-mail: *bioticapublications@gmail.com*

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Abstract

The application of Biofloc technology (BFT) provides advantages in the improvement of aquaculture production that could lead to the achievement of the objectives of sustainable growth. With less environmental impact, this technology may result in higher productivity. In addition, biofloc systems can be built and implemented in conjunction with other food production methods, thus encouraging efficient integrated systems aimed at generating more food and feed from the same land area with less input. In order to optimize the system (in relation to operational parameters), still more research is needed, *e.g.*, in relation to nutrient recycling. Furthermore, research findings would need to be communicated to farmers as upgrading of their skills will be needed to incorporate biofloc technology.

Introduction

As a food-producing profession, aquaculture provides enough opportunities to reduce poverty, hunger and malnutrition, generate economic growth and make better use of natural resources (Food and Agriculture Organization, 2017). Production of aquaculture is expected to increase from 40 million tons by 2008 to 82 million tons by 2050. The need to increase the production of aquaculture was prompted by an increase in demand per capita in parallel with the increase in the global population. One of the strategies to improve the productivity and sustainability of aquaculture should concentrate on improving the use of feed nutrients. Two different methods can develop this, *i.e.,* (1) through improving the feed qualityand feeding strategy in such a way that the nutrients can be distributed and eventually used effectively, and (2) through re-using the nutrient waste by improvements in the culture system. Nutrients may be extracted from an aquatic environment by a variety of natural biogeochemical processes affecting mainly microorganisms that play different roles in nutrient cycles. Unconsumed feed, as well as the digestion and metabolic cycles of feed, are the main sources of nutritional waste in aquaculture systems. Nutrient waste in an aquaculture environment can be re-used directly by animals at lower trophic levels that feed on feed particles, or indirectly by the conversion of nutrients into microbial biomass, which can then be eaten by the cultured animal or another animal as a food supply. The impact of Biofloc systems on nutrient use and wastewater production will be addressed in this paper.

Impact of Biofloc Systems on Nutrient Use

The faster nutrient transfer by microbes in bioflocs or periphyton may provide a more digestible and nutritious additional food source for both the main cultured

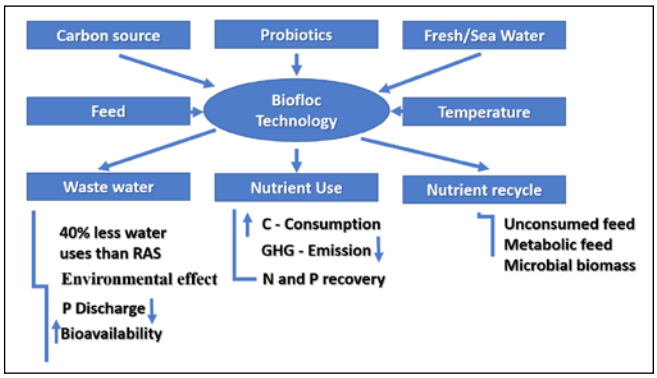

Figure 1: Scheme of Biofloc Technology Impact in Nutrient and Waste water use on Aquaculture

organism and other species introduced into the environment. In this way, the use of unused nutrients should be more effective, and emissions should be reduced. Combining a biofloc system with an integrated multitrophic culture system can improve nutrient utilisation quality. Ekasari (2014) found that mixing a biofloc-based shrimp culture system with tilapia, mussels, and seaweed resulted in higher yield, higher feed N and P recovery by the shrimp, and lower waste nutrient and microbial biomass. Additionally, the addition of seaweed or macrophytes to a biofloc-based integrated aquaculture system can allow for the capture of excess CO_2, resulting in an increase in C consumption efficiency and a reduction in GHG emissions. This improved nutrient consumption efficiency could spur further research into the possibilities of integrating the biofloc system into a multitrophic culture system to reduce the harmful environmental effects of aquaculture nutrient wastes.

Impact of Biofloc Systems on Wastewater Production

According to Luo *et al*. (2014), a biofloc-based tilapia culture system uses 40% less water than a recirculating aquaculture system (RAS). The majority of research using biofloc technology found that the amount of N and P waste in this method could be decreased, confirming the system's function in improving aquaculture production and reducing the environmental effect of aquaculture units. The microbial loop's resource recovery requires heterotrophic bacteria uptake of inorganic phosphorus, which not only reduces discharged P but also increases the bioavailability of this nutrient for cultivated animals. The consumption of microbial biomass in the biofloc can thus encourage P assimilation from the feed to the cultivated species, especially in the indigestible form, reducing nutrient waste.

Conclusion

Biofloc technology has the potential to increase production while reducing environmental effects. The use of Biofloc technologies will help improve aquaculture productivity and lead to the achievement of sustainable development goals. Biofloc systems may be designed and implemented in conjunction with other food production methods, resulting in more efficient integrated systems that tend to produce more food and feed with less inputs from the same amount of land. To optimise the system in terms of nutrient recycling, much more research is required.

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