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Editorial

# Biofloc Technology: Hope for Profitable and Sustainable Aquaculture

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Human's population has now crossed the 8 billion mark. Food security to all is one of prime questions in front of human civilization. Limited land resources, rapidly growing population, poorly managed urbanization and climate change have putted huge pressure on agriculture sector to full fill demand of nutritious and safe food to all. In this situation aquaculture especially fisheries sector is a great hope to us. Traditional, technically unsound practices in fisheries are however are now incompatible. In current environmental scenario intensification of any system should be sustainable with more ecologically sound management practices. It should be designed in a manner to produce less carbon-based pollutants causing less toxic effects and environmental risks. Furthermore, it should have less operational cost and applicable for large scale adoption. Bioflock technology (BFT) is a good option to full fill these counter interacting situations and demands. The BFT was initially started in early 1970s at French Research Institute for Exploration of the Sea for culturing various penaeid species including Litopenaeus vannamei, Litopenaeus stylirostris, Penaeus monodon, and Fenneropenaeus merguiensis. In this technology, heterotrophic and nitrifying bacteria convert fish waste (Nitrogenous metabolites) to biomass (biofloc) with the addition of carbon from the environment. Carbon-to-Nitrogen ratio (C/N) is managed to above 10 in this system by adding carbon sources like molasses, starch, and wheat flour. It may also be achieved by reducing protein content of the feed supplied. Thus if adequate C/N ratio is maintained, nitrogenous wastes will be converted into bacterial biomass. Thus it is an environment friendly aquaculture technique based on *in-situ* microorganism production. Biofloc is the suspended growth in ponds/tanks which is the aggregates of living and dead particulate organic matter, phytoplankton, bacteria and grazers of the bacteria. It is a protein rich live feed formed as a result of conversion of unused feed and excreta into a natural food in a culture system on exposure to sunlight and vigorous aeration. High-density polyethylene (HDPE)-lined ponds with well prepared dikes and aeration system are most preferred for large-scale biofloc fish production. Temperature, dissolved oxygen (DO), pH, salinity, total suspended solids (TSS) and settling solids, alkalinity, and orthophosphate are some of the parameters that should be continuously monitored. Fungi, ciliate, protozoa, rotifer, copepod, and nematodes actively participate in the process of recycling of organic matter. Diatoms are also important because they may supply extracellular polysaccharides as carbon source. So, proper maintenance of whole aquatic community is very important for fruitful result.

*Nitrosomonas*, *Nitrosococcus*, *Nitrosospira*, *Nitrosolobus*, *Nitrosovibrio Nitrobacter*, *Nitrococcus*, *Nitrospira*, and *Nitrospina* are some important bacteria for biofloc technology. Some fungi such as *Candida*, *Cryptococcus*, *Rhodotorula*, and *Debaryomyces* are also reported to enhance biofloc productivity. Microalgae belong to Chlorophyta, Chrysophyta, and Cyanophyta also said to enhance biofloc system productiovity. Ciliate protozoan, rotifers, copepods, cladocerans, nematodes are also essential group in biofloc culture. Three approaches viz. natural transition, inoculum and customization approach are applied for biofloc generation. In natural transition approach, autotrophs are generated through addition of fertilizers, fish/shrimp feed and other ingredients. In inoculums approach fermented products of the carbon source (rice bran, molasses, etc.) are aerated with the source water (of previous crop) for biofloc generation. It is a time-saving process therefore; biofloc can be generated in a very short duration. Customization approach utilizes probiotics to maintain healthier environment. Biofloc is very nutritious and can be used as a complete aquatic food source and supply bioactive compounds. Feed conversion ratio (FCR) gets reduced to considerable ratio as compared to systems using clear water. The exact mechanism of growth enhancement by microbial

flocs is unknown, but it is supposed that continuous consumption of native proteins possess a growth factor that improves the growth of the crop. It may also improve ingestion and digestion of supplied feed and also the reproductive performance and egg quality. In addition to this biofloc technology can help to conserve the amount of water required in aquaculture. It requires limited water or zero water exchange as compared to traditional aquaculture techniques and even new developed recalculating aquaculture systems (RAS) in some cases. Waste water is well utilized in this technology. Very less land area is required for pond set up. Biofloc technology improves biosecurity. The biofloc system is responsible for increasing the growth rate and reducing the feed conversion ratio, which eventually increases profitability and reduces aquaculture costs. Operating cost may be very high as compared to traditional systems, however profit is far more. Air breathing fish like Singhi (*Heteropneustes fossilis*), Magur (*Clarias batrachus*), Pabda (*Ompok pabda*), Anabas/Koi (*Anabas testudineus*), Pangasius (*Pangasianodan hypophthalmus*), non air-breathing fishes like Common Carp (*Cyprinus carpio*), Rohu (*Labeo rohita*), Tilapia (*Oreochromis niloticus*), Milkfish (*Chanos chanos*), shellfishes like Vannamei (*Litopenaeus vannamei*) and Tiger Shrimp (*Penaeus monodon*) are well suited for biofloc culture. Therefore biofloc technology is an eco-friendly that reduces environmental impact. It promotes judicial use of land and water. High productivity with high biosecurity is achieved in cost effective manner. It reduces water pollution. Thus this technology is a hope for food security, economic growth and environmental well being.