

## BIOFLOC TECHNOLOGY (BFT) FOR FARMING OF FISH IN LAND LOCKED AREAS

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### Introduction

Biofloc technology (BFT) is an innovative aquaculture system that focuses on maintaining a healthy and sustainable aquatic environment for the production of food fishes in captivity. The basic principle of BFT is the retention of waste (such as uneaten feed, feces, and other organic matter) and its conversion into natural food called biofloc which consist of a mixture of suspended organic matter, microorganisms, and small particles, through the activity of microbes, particularly bacteria, algae, and other microorganisms within the culture system. This is done by beneficial bacteria under constant aeration and addition carbon sources. The organic matter undergo aerobic decomposition and maintain high levels of microbial floc in suspension in biofloc tank or fertilized ponds (Avnimelech *et al.*,1986, Avnimelech1999, 2007).

### The key principles of BFT:

1. **Waste Retention:** Instead of discharging waste into the environment or relying on water exchanges to maintain water quality, BFT systems maintain and manage waste in the culture system. This waste is primarily from uneaten feed and fish excretion, which are naturally converted into beneficial bioflocs.
2. **Biofloc Formation:** The waste organic matter (e.g., uneaten feed, feces) serves as a nutrient source for microorganisms. These microorganisms, including bacteria, algae, and protozoa, break down the organic matter into simpler compounds, and this process results in the formation of biofloc—aggregates of microbial biomass, detritus, and particles suspended in water.
3. **Conversion to Natural Food:** The biofloc itself becomes a **natural food source** for the cultured organisms, such as fish or shrimp. The microorganisms in the biofloc are consumed by the aquatic organisms, providing them with nutrients such as proteins, vitamins, and minerals. This reduces the need for external feed, which can lower feed costs and increase sustainability.
4. **Water Quality Management:** The microbial community in the biofloc system helps maintain water quality by converting toxic ammonia and nitrite (produced by the fish) into less harmful compounds, thus enhancing the overall health of the aquaculture system. The presence of biofloc helps in maintaining a balanced nitrogen cycle and controlling water pollution.
5. **Sustainability:** Biofloc technology promotes a more **sustainable** aquaculture system by recycling nutrients and reducing the reliance on external feed and water exchange. The system can significantly reduce water usage and waste output, making it suitable for areas with limited water resources.

Biofloc Technology (BFT) is considered as new “blue revolution” since nutrients can be continuously recycled and reused in the culture medium, benefited by the minimum or zero-water exchange. The BFT creates a self-sustaining aquaculture environment where waste is not merely a pollutant but a resource that can be converted into useful food, improving both the environmental impact and

productivity of the system. BFT is an environment friendly aquaculture technique based on *in-situ* microorganism production.

### Advantage of BFT

- Eco-friendly fish culture system .
- Enables high density fish farming
- It reduces environmental degradation .
- Effective and judicious use of land and water
- Limited or zero water exchange system
- High survival, growth and feed conversion
- Reduces the need for external feed
- Enables fish culture in land locked and interior locations
- Alternative method for production of fish protein
- Reduces threat of poaching.
- Less land is required.

### Criteria for Selection of species for BFT

- Species should able to derive nutrients from floc by directly consuming biofloc.
- Should able to tolerate high solids concentration in water.
- Should able to tolerate fluctuating water quality.
- High Growth rate
- Consumer preference

### Fish Species suitable for Biofloc Culture

Non air-breathing fishes like **Gift Tilapia**, Tilapia (*Oreochromis niloticus*), Common Carp (*Cyprinus carpio*), Rohu (*Labeo rohita*), Milkfish (*Chanos chanos*)

Air breathing fish like Anabas/Koi (*Anabas testudineus*), Magur (*Clarias batrachus*), Singhi (*Heteropneustes fossilis*), Pabda (*Ompok pabda*), Pangasius (*Pangasianodon hypophthalmus*)

Murrels: Snakehead murrel *Channa striatus* (CS) (in clear water )

Shellfishes like Vannamei (*Litopenaeus vannamei*) and Tiger Shrimp (*Penaeus monodon*)

Biofloc Tank size and capacity

| Sl No | Tank Diameter (Meters) | Approximate volume maintained (Litres) |
|-------|------------------------|--|
| 1     | 2 m dia                | 4000                                   |
| 2     | 3 m dia                | 14000                                  |
| 3     | 4 m dia                | 25000                                  |
| 4     | 5 m dia                | 39000                                  |
| 5     | 6 m dia                | 56000                                  |
| 6     | 20 m dia               | 628000                                 |

## Biofloc Base and Tank preparation

A cylindroconical basement (sloping towards centre) for the biofloc tank is made for the required diameter with central drain out lines and over flow pipe. After the construction, the biofloc frame is placed on the basement and the sides of frame are fixed with nut and bolt. After this the pond is lined with anti-rat sheet, soft net sheet or polyform sheet and then lined with 600 GSM pond liner with fixing central drain. The pond is also connected with syntex tank for water connection and a float valve is fixed in the biofloc tank to enable automatic filling of water.

The tank is also provided with aeration so that an oxygen level of 5.0 to 6.5 mg/l is maintained. Once the pond is filled with water, the tank is aerated for 24 hrs for conditioning the water and to maintain water quality.





### **Floc preparation (5 m dia tank with 39000 L )**

Take 3-5 kg of Jaggery and boil in 5 litres of water and cool it over night. Next day sieve this jaggery solution and add to 100 to 200 litre water in a bucket and aerate vigorously. Dissolve 15-50 gm floc powder in 1 litre water with constant stirring. Add this inoculum to the 200litre jaggery solution and aerate for 24 hrs. After 24hrs, add this cultured inoculums to biofloc tank water, provide aeration and allow the pond to mature for 5 to 7 days. Daily floc level need to be examined using Imhoff cone. If the floc level is less, additional carbon source (Sugar/ Jaggery, Wheat flour /Tapioca flour) can be added to maintain CN ratio in the biofloc system. After 7 days the tank will be ready for stocking fish seed.

### **Seed Stocking & Feeding**

The seeds of required fish can be stocked as per tank size. Feeding of fishes with pellet feed (0.5 to 1.0mm) depending on size of fish can be started after 2 - 12 hrs of stocking depending upon species. The feed ration can be from 2 to 3 % of body weight per day. The feed size can be increased from 0.5mm to 0.6, 0.8, 1.0, 1.2, 1.8, 2.5, 3.0, 4.0, 5.0 and 6.0mm during the period of 10 months culture period after ensuring growth. The major pellet feeds used are Growel, Nutrilla, Cargill Unomei and Skretting fish feed. Feeding should be done 3 to 4 times per day in split dose depending upon species.

### **Environmental parameters**

Daily bottom water need to be drained out in the morning and evening to remove feces. Top up the tank with fresh water to maintain water level. Environmental parameters like Dissolved oxygen (DO), pH, floc levels need to be measured once in a week and corrective measures to be taken. Daily monitoring of Floc level, its colour and liveness of floc may be monitored for corrective measures.

### **Growth measurements**

The fish growth need to be ascertained every month and health of fish also should be considered. Depending upon growth, the feed size and feed quantity need to be adjusted.

### **Harvesting**

The harvesting can be done during 8 to 10 months of culture period depending upon growth.



Fig 3 . Seed stocking in 5 meter dia biofloc tank

## References

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