# New Concept of Biofloc Technology (BFT)

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Globally, the aquaculture sector is the fastest-growing food-producing sector, as the demand for low-cost animal protein is increasing due to the shortage of protein food supply in many countries to feed the ever-growing population. Presently, the total world fishery production is about 178 MT, of which aquaculture production is 87.5 MT, which contributes about 62.2% of the total Production (Sofia 2022).The enormous increase in aquaculture production is due to the introduction of high-density intensive culture practices.

Apart from these benefits, intensive culture systems are also associated with some environmental and economic problems because, it requires more than 50% of the total production cost is driven to feed only. However, only 20- 30% of feed is utilised by the culture species; the remaining 70-80% will be accumulated as organic waste (uneaten feed and excretory products) in pond water, leading to water quality deterioration, affect culture species in terms of growth, survival and ultimately causes disease outbreaks. Moreover, aquaculture also has some limitations like less availability of land, water, feed ingredients and bio security measures.

To overcome these above problems application of an environmentally friendly culture system known as "Biofloc Technology" is more advantageous, it is a green culture system in which nutrients are reused and recycled continuously with minimum or zero water exchange. It is mainly based on the growth of microorganisms (bio-floc), which helps to improve the water quality by the uptake of nitrogen and to produce a microbial protein; in addition, FCR can be reduced, which ultimately reduces the feed cost.

## Biofloc

Biofloc is the heterogeneous macro aggregations of algae, diatoms, protozoa, microbial grazers, filamentous and floc forming bacteria with uneaten feed, faeces, and sludge, which were grouped into floc biomass by a biological adhesive such as poly-

| Sr. No. | Component | Percentage |
|---|---|---|
| 1 | Protein | 24.3 - 53.85 % |
| 2 | lipid | 0.5 -5.4 % |
| 3 | Fibre | 0.7 - 16.65 % |
| 4 | carbohydrate | 21.1 -81.5 % |
| 5 | Ash | 6.31 – 31.9 % |
| 6 | Nitrogen free extract | 18- 29.24 % |
| 7 | Energy | 12 – 19 Kj/g |

hydroxyalkanoates (PHA) released by the microorganisms within the water column. Bio-flocs are very light, highly porous, delicate and irregular in shape and vary from 50-200 microns (reach up to 1000microns) in size.

**Proximate composition of biofloc**

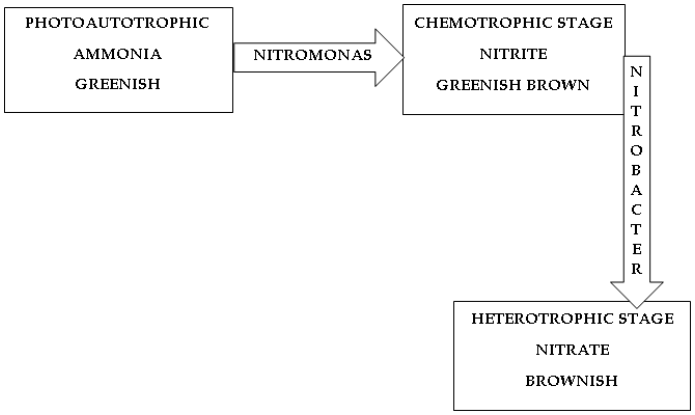
The nutritional values in the bio-floc mainly depend on what type of carbon source is used

**Principle Of Biofloc:** "Nitrogenous wastes present in the uneaten feed and animal excreta are converted into a consumable 'bacterial floc', with the addition of carbon sources at high oxygen levels with limited (less than 10%) or zero exchange of water "(Schneider et al. 2005, Avnimelech 1999; Crab et al. 2009) due to continuous aeration, and carbon supply, usually highest densities of biofloc are observed in this system only. In this system, algae won't grow sufficiently or not at all grow and this biofloc system is solely based on bacteria, hence it is called as "True/brown biofloc system". This system is alone recommended for shrimp/ fish culture.

**C:N ratio**: C/N ratio plays a vital role in the formation of bacterial biomass from the organic waste

accumulated in the water. Carbon enhances the growth of heterotrophic bacteria.

**C:N ratio of 10:1 holds good** for the biofloc technology but, in some cases the ratio may exceed depending on the need of the heterotrophic bacteria15:1 to 20:1. Therefore a well-balanced carbon source is added in the form of jaggery, molasses, glycerol etc.




**Formation of biofloc**: Continuous aeration in the pond water promotes the biofloc development by oxidising the ammonia in three stages that can be identified based on water colour as following.

1. Photo autotrophic stage: This is the very initial stage of the biofloc system, the water appears in green colour due to the growth of filamentous microalgae such as chlorella, spirogyra, algae, anabaena and Oscillatoria are mostly dominated.

2. Chemotrophic stage: It is the later nitrifying stage, in this system nitrifying bacteria such as Nitrosomonas, Nitrobacter and pseudomonas are mostly dominated as they convert the toxic ammonia to less toxic nitrite and water appears in the form of greenish brown in colour.

3. Heterotrophic stage: water appears brown in colour due to the domination of heterotrophic bacteria and these bacteria take the nitrogen and produce a singlecelled microbial protein. in this stage nitrite gets converted into nitrate.

**Preparation of floc**

Wash the tank or pond and then allow it to dry, now fill the water up to 35-50% of the tank capacity and start aeration and let it continue for 24 hrs. Initially TDS will be in the range of 800-1000ppm, in biofloc TDS should be high in order to increase Add 1kg of salt/10,000lit. of water to maintain the total dissolved solids (TDS) range between 1400 to 1600(Do not use iodised salt, use only raw salt).

The Ph of the unit should be in the range of 7.5-8.5 and Ph corrections should be done by adding lime or gypsum depending on the situation.

After proper aeration and when the system is having optimal Ph and TDS now add urea @1g/1000litres or Triple Super Phosphate @ 0.14g/1000 liters as nitrogen source.

After addition of nitrogen source only carbon source is added@7gms/1000litres, if using jaggery add 2gms/1000litre of water.

After one day add probiotic powder @ 20g/1000lit. to enhance the performance of the immune system. And continue the process of aeration and within 7-10 days floc is formed in the system.

After required floc volume is obtained then stock the system and culture until the days of culture are over.

Shell fishes are stocked @ 250-500pl/m²and for finfishes it is stocked @150-200 fingerlings/m2.2000kg /6months is produced in a 1acre area.

NOTE: From 1gm of ammonia, about 15.85gm of algae biomass; 0.2gm of nitrifying bacteria; 0.87gm of heterotrophic bacteria can be produced.

Daily add 600gm of carbon for every 1kg of feed (maintenance phase@ 0.6:1) added until the floc reaches10- 15ml/L to maintain a C/N ratio of 10:1.

Ideal density of floc is 10-15ml/L for shrimp and 25 - 35ml/L for fish.

**Preferrable species for biofloc technology**

Fish / shrimp species that can tolerate high stocking density, high total suspended solids concentrations, intermediate levels of DO, TAN and filter-feeding / omnivorous habit are best suitable.

1. Non air breathing fishes: *Labeo rohita*, Common Carp, Grass Carp, Silver carp,Tilapia (*Oreochromis aureus, O. niloticus, O. mossambicus*).

2. Air breathing fishes: Magur (*Clarius batrachus*), Murrels, *Anabas*, Channel catfish, and *Clarias gariepinus.*

3. Shell fishes: *Litopenaeus vannamei* (Indian white leg shrimp) and *Penaeus monodon* (Tiger shrimp).

Among all the cultural species *Litopenaeus vannamei* and Tilapia are highly recommended to culture in bio-floc technology as they are filter feeders with omnivorous/ detritivorous habit and can also withstand poor water quality conditions.

**Advantages**

- ✓ It is a green approach to reducing the environmental impact and increases the biosecurity.
- ✓ High productivity compared to conventional fish farming.
- ✓ Increased growth and survival rate of cultured species
- ✓ Lower the feed conversion ratio (FCR) as biofloc acts as alternative feed thereby reduces the feeding cost.
- ✓ High stocking density in less space
- ✓ Consuming the floc biomass enhances the immune system of culture species
- ✓ Improves the water quality by recycling the nutrients
- ✓ Zero water exchange or a minimum of 10% is exchanged.

**Disadvantages**

- ✓ Maintaining a constant C/N ratio is problematic during culture as it is maintained all the days of culture.
- ✓ As it requires continuous aeration it consumes more power on a whole.
- ✓ A continuous supervision is required to Monitoring floc volume, oxygen saturation, and ammonia levels requires highly skilled persons and a fully equipped laboratory at the farm only.
- ✓ High turbulence may also lead to floc breakage as they held together by a loose matrix.

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