RECENT TRENDS IN AQUACULTURE

BIOFLOC FISH CULTURE

सत्यमेव जयते

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Introduction

The global population is expected to reach 9.6 billion by Yr. 2050 and as the demand for animal protein is increasing year by year it is a challenge to provide quality protein by safeguarding its natural resources for future generations. In this context, aquaculture plays a key role in promoting health by providing animal protein as well as generating employment and economic growth.

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. BFT 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 the utilization of microbial processes within the pond/tank itself to provide food resources for cultured organism while at the same time acts as a water treatment remedy. Thus, this system is also called as active suspension ponds or heterotrophic ponds or even green soup ponds**.**

How BFT works?

- ✓ Biofloc system is a wastewater treatment which has gained vital importance as an approach in aquaculture.

- ✓ The principle of the technique is to maintain the higher C-N ratio by adding carbohydrate source and the water quality is improved through the production of high quality single cell microbial protein

- ✓ In such condition, heterotrophic microbial growth occurs which assimilates the nitrogenous waste that can be exploited by the cultured species as a feed and also works as bioreactor controlling of water quality.

- ✓ Immobilization of toxic nitrogen species occurs more rapidly in biofloc because of the growth rate and microbial production per unit substrate of heterotrophs are ten-times greater than that of the autotrophic nitrifying bacteria.

- ✓ This technology is based on the principle of flocculation within the system

Composition and Nutritional Value of Biofloc

Biofloc is a heterogeneous aggregate of suspended particles and variety of microorganisms associated with extracellular polymeric substances. It is composed of microorganisms such as bacteria, algae, fungi, invertebrates and detritus, etc.

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.

Each floc is held together in a loose matrix of mucus that is secreted by bacteria and bound by filamentous microorganisms or electrostatic attraction. Large flocs can be seen with the naked eye, but most of them are microscopic. Floc size range from 50 – 200 micron.

A good nutritional value is found in Biofloc. The dry weight protein ranges from 25 – 50%, fat ranges 0.5 – 15%. It is a good source of vitamins and minerals, particularly phosphorous. It has an effect similar to probiotics. The dried biofloc is proposed as an ingredient to replace the fishmeal or soybean in the feed.

Advantage of BFT

- Eco-friendly culture system.
- It reduces environmental impact.
- Judicial use of land and water
- Limited or zero water exchange system
- Higher productivity (It enhances survival rate, growth performance, better feed conversion in the culture systems of fish).
- Higher biosecurity.
- Reduces water pollution and mitigate the risk of introduction and spread of pathogens
- It reduces utilization of protein rich feed and cost of standard feed.
- It reduces the pressure on capture fisheries *i.e.*, use of cheaper food fish and trash fish for fish feed formulation.

Species suitable for Biofloc Culture

- **Major cultivable fish species in BFT**

A basic factor in designing a biofloc system is the species to be cultured. Biofloc system works best with species that are able to derive some nutritional benefits from the direct consumption of floc. Biofloc system is most suitable for species that can tolerate high solids concentration in water and are generally tolerant of poor water quality. Some of the species that are suitable for BFT are:

- 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*)

How to Prepare the Inoculum?

Method 1:

For 15000 Litres of fresh water 150 Litres of inoculum is required for the floc development

Step 1

Take clean tub/can with 150 Litres of water and continue vigorous aeration

Step 2

Add 3 Kg of pond soil

+

1.5 gm of Ammonium sulphate /Urea

+

30 gm of carbon source (Jagerry /Wheat flour /Tapioca flour)

Step 3

Mix it well with water in tub and provide adequate aeration

Step 4

The inoculum will be ready after 24-48 hrs and it can be transferred to main tank

- Daily addition of carbon source is required for the development of floc. For every 1 kg of feed given (with 25 % of crude protein), 600 gm of carbon source is to be added to the system to maintain C: N of 10:1.
- Once the floc volume reaches 15-20ml further addition of carbon source is not required

Method II:

Step 1

Take clean tub/can with 130 Litres of water and continue vigorous aeration

Step 2

Add 20 Litres of pond water/RAS water (before filtration)

+

30 gm of carbon source (Jagerry /Wheat flour /Tapioca flour)

+

10 gm of probiotic (with *Bacilus* Sp., *Aspergilus* Sp. etc with a total concentration of $10x10^9$ CFU/gm)

Follow the remaining steps as mentioned in **method 1**

***NB: Well developed inoculum will be turbid with foam on the water surface (Ideal Volume of Floc in Imhoff cone for shrimp is 10-15 ml/L and for Fish 25-35 ml/L)**

Floc volume measurement with Imhoff cone

Technical Specifications- 100 m^3 (7 Tanks)

S.No	Component	Details
1	Area for 7 tanks	200 m^2
2	Biofloc Tank size	4 metre diameter and 1.5 meter height (1.20 m water depth)
3	Water holding capacity of each tank	15,000 Litres capacity
4	Water quality parameters	Dissolved Oxygen-5mg/L, Temparature-26-34°C, pH-7.5 to 8, TDS-600ppm, Floc density-25-40 mg/l, Ammonia-0.5 ppm, Nitrite-0.3 ppm, Nitrate-150 ppm, Alkalinity-120-280 ppm
5	Tanks Made-up of	Tarpaulin/Fibre/HDPE
6	Stocking density	100 nos/m^3 (1000 no.s per 15,000 litres tank - depending on species)
7	Species cultured	GIFT Tilapia (*Oreochromis niloticus*)
8	Survival (%)	80
9	Type of feed to be used	floating pellet feed
10	% of feed	2-3% per Average Body weight
11	Feeding frequency	4 times early stage, later 2 times per day
12	FCR	1:1.2
13	Duration of culture	6 months
14	Size/weight of the species(gm)	500 gm average weight
15	No. of crops per year	2
16	Production	4.2 Tonnes per crop (600kg per tank per crop)
17	Farm gate price(Rs)	130/- kg fish
18	Capital cost	6.00 Lakhs
19	Input cost	1.5 lakhs per one crop
20	Total project cost	7.5 lakh

Cost Estimates of Biofloc Unit with 7 Tanks

S.No	Component	Nos	Cost (Rs)	Total (Rs in lakhs)
Capital cost				
1	Setup of Tarpaulin/Fibre tanks(15,000 Litres capacity)	7	25,000	1.75
2	Shed material and accessories fixing charges	200 m^2	120000	1.20
3	Water supply borewell(3HP)	1	100000	1.00
4	PVC pipe fittings for air, water flow	LS	75000	0.75
5	Nets and accessories	5	3000	0.15
6	One Blower (1 HP), Air stones and other accessories	1	30000	0.30
7	Electrification	LS	10000	0.10
8	Power generator(2 KVA)	1	45000	0.45
9	Weighing balance	1	5000	0.10
10	Miscellaneous expenses			0.20
Total Capital Cost				**6.00**
***Input cost for one crop**				
11	Seed cost, Feed cost, Probiotics, Test kits etc.			1.50
Total Input cost (per one crop)				**1.50**
Grand Total				**7.50**

*input cost may vary depending on stocking density

Economic feasibility (one crop) from 7 Tanks

Sl	Components	Amount (Rs in lakhs)
1	Capital Cost	6.00
2	Operational Cost	1.50
3	Total project Cost	7.50
4	Gross income per crop	5.46
5	Gross income at the end of one crop after deducting the recurring cost for the 2nd crop	3.96
6	Gross income from the 2nd crop	5.46
7	Gross income at the end of 2nd crop	9.42
8	Depreciation/maintenance @ 15% of capital cost	0.975
9	Interest @ 12% of TPC	0.90
10	Repayment @ 1/7th of the TPC	1.07
11	Recurring cost for the next crop	1.50
12	Net profit at the end of 2nd crop 9.42- (0.975+0.9+1.07+1.50)	4.975

Model Cost Calculation

- **Model Capital Cost Break up for Biofloc with 50 tanks of 4m dia and 1.5 m height**

S.No	Component	Nos	Cost (Rs)	Total (Rs in lakhs)
Capital cost				
1	Setup of Tarpaulin/Fibre tanks(15,000 Litres capacity)	50	25,000	12.50
2	Shed material and accessories fixing charges	1600 m^2	600/m^2	9.60
3	Water supply bore well and pump (2 nos. of 3 HP)	-	150000	1.50
4	PVC pipe fittings for air, water flow	LS	550000	5.50
5	Nets and accessories	50	3000/tank	1. 50
6	Blower (1 HP), Air stones and other accessories	8	30000	2.40
7	Electrification	LS	200000	2.00
8	Power generator(5 KVA)	1	150000	1.50
9	Miscellaneous expenses			0.50
Sub Total				**35.50**
Input cost for one crop** **(input cost may vary depending on stocking density**)**				
10	Seed @Rs.4/- for 50000			**2.00**
11	Feed cost @Rs.30/kg for 24 T			**7.20**
12	Probiotics, carbon source, test kits, electricity etc.			**5.30**
Sub total				**14.50**
			Grand Total	**50.00**

- **Model Capital Cost Break up for Biofloc with 25 tanks of 4m dia and 1.5 height**

S.No	Component	Nos	Cost (Rs)	Total (Rs in lakhs)
Capital cost				
1	Setup of Tarpaulin/Fibre tanks(15,000 Litres capacity)	25	25,000	6.25
2	Shed material and accessories fixing charges	800 m^2	600/ m^2	4.80
3	Water supply bore well and pump (2 nos. of 3 HP)	1	150000	1.50
4	PVC pipe fittings for air, water flow	LS	250000	2.50
5	Nets and accessories	25	3000/tank	0.75
6	Blower (1HP), Air stones and other accessories	4	30000	1.20
7	Electrification	LS	100000	1.00
8	Power generator(5 KVA)	1	150000	1.50
9	Miscellaneous expenses			0.50
Sub Total				**20.00**
Input cost for one crop** (input cost may vary depending on stocking density**)*				
11	Seed cost @ Rs.4 for 25000			**1.00**
12	Feed cost @ Rs.30/kg for 12 T			**3.60**
13	Test kit, carbon source, electricity charges etc.			**0.40**
Sub Total				**5.00**
			Grand Total	**25.00**

- **Model Cost Break up for Construction of Biofloc ponds for Brackish water/ Saline/ Alkaline areas including inputs of Rs. 8 lakhs/0.1Ha**

Capital cost		
S.No	**Component**	**Total (Rs in lakhs)**
1	Earth work excavation and construction of bund	0.50
2	Polyethylene lining	1.50
3	Inlet, outlet and central drainage system	0.50
4	PVC pipe fittings for air, water flow	0.50
5	Pump house-100sqf	1.00
6	Pumps-1 nos. 3 HP	0.30
7	Aerator-4 nos. @Rs.25,000	0.70
8	Air Blower	0.30
9	Aeration tubes	0.30
10	Generator set 10 KVA	2.00
11	Net, Imhoff cone, weighing balance, water testing kits and other accessories	0.30
12	Bio security Measure-Bird net, crab net	0.20
13	Electrification L.S.	0.50
14	Watchman shed-10sqf	1.00
13	Miscellaneous	0.40
Total		**10.00**

Input Costs		
Sl. No	**Components**	**Total Amount (in Lakhs)**
1	Seed cost @ Rs.0.40/pc for 300000	1.20
2	Feed cost @ Rs.70/kg for 6MT	4.20
3	Electricity and fuel	1.00
4	Harvesting charges	0.20
5	Miscellaneous/transportation etc	0.60
	Total	**8.00**

Grand Total: Rs. 18 lakhs

- **Model Cost Break up for Construction of Biofloc ponds for Freshwater areas including inputs of Rs. 4 lakhs/0.1Ha**

Capital cost		
S.No	**Component**	**Total (Rs in lakhs)**
1	Earth work excavation and construction of bund	0.50
2	Polyethylene lining	1.50
3	Inlet, outlet and central drainage system	0.50
4	PVC pipe fittings for air, water flow	0.50
5	Pump house-100sqf	1.00
6	Pumps-1 nos. 3 HP	0.30
7	Aerator-4 nos. @Rs.25,000	1.00
8	Air Blower	0.30
9	Aeration tubes	0.30
10	Generator set 10 KVA	2.00
11	Net, Imhoff cone, weighing balance, water testing kits and other accessories	0.30
12	Bio security Measure-Bird net, crab net	0.20
13	Electrification L.S.	0.50
14	Watchman shed-10sqf	1.00
13	Miscellaneous	0.10
Total		**10.00**

Input cost		
Sl. No	**Component**	**Total Amount (In Lakhs)**
1	Seed cost @ Rs.3/pc for 10500	0.30
2	Feed cost @ Rs.30/kg for 10MT	3.00
3	Electricity and fuel	0.70
	Total	**4.00**

Grand total: Rs.14 Lakhs

Biofloc Scheme under PMMSY-

Beneficiary oriented sub-components and activities				
S.no.	**Sub-component and activities**	**Unit**	**Unit cost (Rs. Lakhs)**	**Page No.**
A	**Enhancement of production and productivity**			
1	**Development of inland fisheries and aquaculture**			
1.11	Construction of biofloc ponds for brackish water/saline/alkaline areas including inputs of rs.8 lakhs/ha	0.1 ha	18.00	85-86
1.12	Construction of biofloc ponds for freshwater areas including inputs of rs.4 lakhs/ha	0.1 ha	14.00	86-87
5	**Technology infusion and adaptation**			
5.1	**Biofloc (50 tanks of 4m dia and 1.5 high) culture system**.	(No)	50.00	120
5.2	**Biofloc culture system (25 tanks of 4m dia and 1.m**	(No)	25.00	120
5.3	**Biofloc (7 tanks of 4m dia and 1.5 high) culture system**	(No)	7.50	121

How to avail subsidy?

- Beneficiary needs to submit the project report (PR) along with required documents including documentary evidence of availability of requisite land (either own/registered lease document to the **concerned District Fisheries Office** for further process. In case of leased land, proper registered lease document for a period of 7(seven) years from the date of submission of SCP will have to be submitted.

- Project report (PR) with full justification & technical-economical details including the species to be cultured, capital cost and the recurring cost involved. Project report should also contain details of anticipated direct & indirect employment generation to local population, enhancement of fish production, specific time lines for implementation of project etc has to be furnished to DFO.

- In case of Biofloc in Pond, the governmental assistance is restricted to (a) 2 units of 0.1 ha per individual beneficiary, (b) 2 units of 0.1 ha multiplied by the number of members of the group/society with a ceiling of 20 units of 0.1 ha per group/society in case of Groups of fishers and fish farmers i.e. fisher SHGs/Joint Liability Groups (JLGs)/Fisher Cooperatives etc. or those undertaken in a cluster/area approach.

- In case of Biofloc in tank, governmental assistance will be restricted to one unit of large or one unit of Medium or 1 of small BFT for individual beneficiary. Governmental assistance will be restricted to 2 units of large or 3 unit of Medium or 4 units of Small BFT per group/society in case they are taken up by Groups of fishers and fish farmers

- However, a cluster/area may have multiple groups/societies. As far as FFPOs/Cs are concerned, the modalities of implementation and upper ceiling on the total area eligible for support would be decided by the CAC.

Training/Technical Guidance:

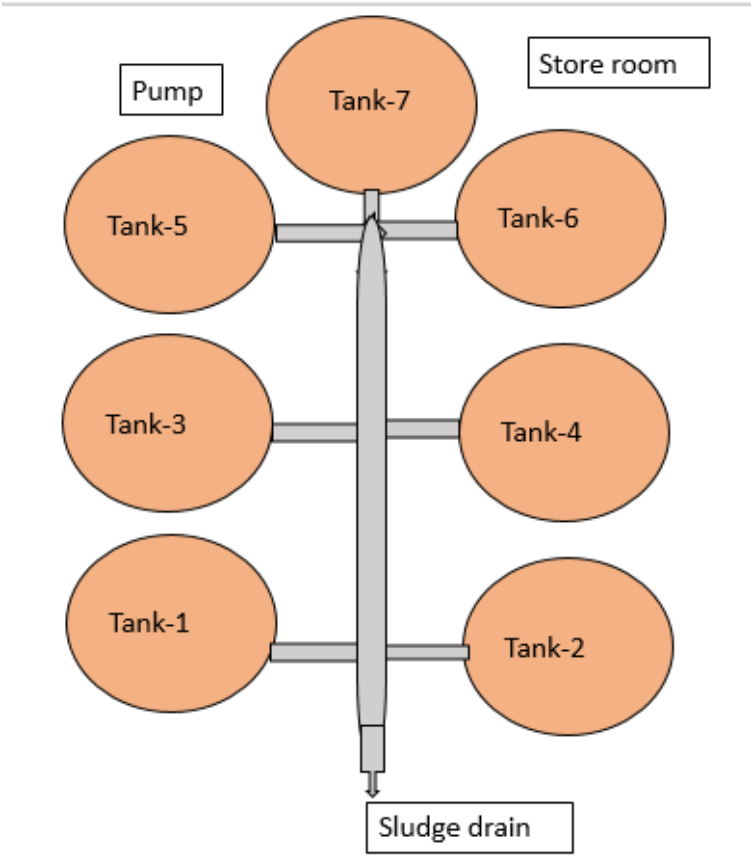
For Training and experience the below may be contacted:

Dr. Babitha Rani A. M.
Senior Scientist, Division of Aquaculture, ICAR-CIFE,
Yari Road, Pin, Off, Panch Marg, Versova, Andheri West, Mumbai,
Maharashtra 400061
Mob: 9867315699
E-mail: babitarani@cife.edu.in

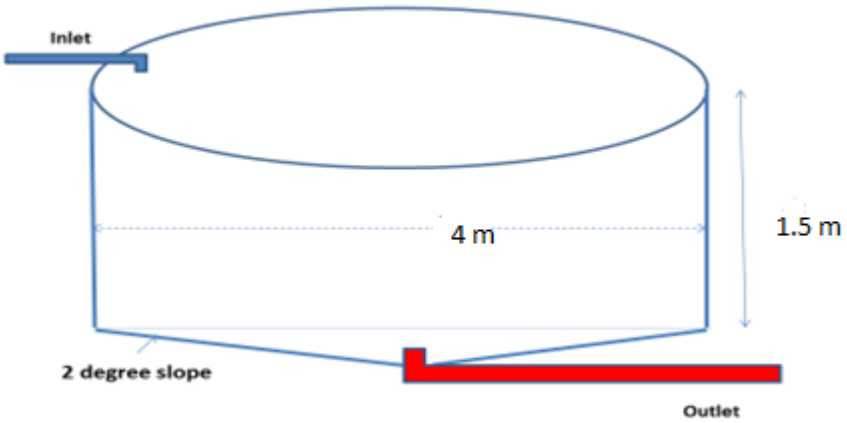
Successful Biofloc farmer: Following is one of the successful Biofloc farmer from the state Bihar-

Mr. Rajeev Kumar Dheer
Pidauli (Vill), Teghra (Tehsil)
Begusarai-851133, Bihar
Mob: 9472808491

Layout and Design



Cross section of one tank



List of Tank Manufacturers/Polythene liner suppliers			
Name of the Manufacturer	**Address**	**Contact number**	**E-mail**
M/s R.S Polymers	BN 85, Block BN, West Shalimar Bagh, Near Darbari Lal D. A. V. Model School, New Delhi-110088	Mr. Siddharth Mehta Mob: 9999997454	rspolymers2000@yahoo.com
M/s Ambrotechs	Indian Office: H.No.8-2-248/A/B, Ground Floor, Road No.3, Land Mark: Chutney's, Banjara Hills, Hyderabad - 500034.	Mr. Jagan Katuri, Mob: 7330666330/ 9542357290 Indian Office: Mob: 98662 69142	jagan.katuri@iprotechs.com
M/s Garware Technical Fibres Ltd	Plot No. 11, Block-D-1, MIDC, Chinchawad, Pune , Maharashtra-411019	Mob: 9325342448 Ph: +91-20-27990301 | +91-20-27990306	zbutt@garwarefibres.com
M/s Texel Industries Limited	Block No. 2106, Santej – Khatraj Road, Near Shah Alloys Ltd., Santej, Kalol (N.G), Gandhinagar, Gujarat- 382721	Mob: 89800 26110 / 89800 26220 / 89800 24320	sales@geotexelin.com / info@geotexelin.com
M/s Das & Kumars	D 63/10, Mahmoorganj Varanasi 221010, Uttar Pradesh	Ph: 91-542-2220521 / 2220414	sales@daskumars.com / daskumars@yahoo.com
M/s Plastikraft, Aurangabad	Traffic Signal ATM, 6, Basement, Konark Arcade, Beside Sant Sawta, Gajanan Maharaj Mandir Rd, nr. Aurangpura, Maharashtra 431001	Mob: 93704 52289	plastikraftone@gmail.com
M/s Redox A/S, Norway (Oxygen Genset & micro bubble generator)	Indian Office: 93/D 1 Regent Estate, Kol-92, India	Mr. Pritam Banerjee Mob-7044081269	office-kolkata.india@redox.no

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