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ROLE OF BENEFICIAL MICROBES IN BIOFLOC TECHNOLOGY

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ABSTRACT

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 zero water exchange. BFT is an environment friendly Aquaculture technique based in 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's. It is the utilization of microbial processes within the pond/tank itself to provide food resource for cultured organism while at same time acts as a water treatment remedy.

Key words: Biofloc technology (BFT), Useful microbes, Sources and their Role in culture medium.

Introduction:

The Biofloc is a protein rich macro aggregate of organic material and micro-organisms including diatoms, bacteria, protozoa, algae, faecal pellets, remains of dead organisms and other invertebrates**.** 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 involves the manipulation of the culture system's C:N ratio to promote bacterial community growth to convert toxic nitrogenous wastes and organics into functional microbial protein; this protein can be used as food source and mediate water quality[(1).] Bioflocs (BFs) contains organisms such as bacteria, microalgae, yeast, rotifers, ciliates, protozoans, nematodes, copepods and crustaceans (Monroy-Dosta *et al.*, 2013, Collazos-Lasso and Arias-Castellanos, 2015, Khanjani *et al.*, 2022a, Khanjani *et al.*, 2022b). The heterotrophic bacteria use the organic compounds as a carbon source. This community can minimize ammonia accumulation in the water column through incorporation as bacterial biomass. Under suitable conditions (temperature, carbon: nitrogen ratio, pH, etc.), bacteria have a fast growth[(2)]. Normally, there is enough nitrogen in ponds for new cell production. By adding carbohydrates (eg. Starch, flour, molasses, cassava etc.) to the pond, heterotrophic bacterial growth is stimulated and nitrogen uptake through the production of microbial proteins takes place.

Then, there is a need for nitrogen. If carbon and nitrogen are well balanced in the solution, ammonium in addition to organic nitrogenous waste will be converted into bacterial biomass. The way to do it: Keep C/N ratio higher than 10. The bacteria now take the nitrogen from the water and control water quality. This promoted nitrogen uptake by bacterial growth decreases the ammonium concentration more rapidly than nitrification. Immobilization of ammonium by heterotrophic bacteria occurs much more rapidly because the growth rate and microbial biomass yield per unit substrate of heterotrophs are a factor 10 higher than that of nitrifying bacteria. Bacteria are very small. Luckily, when we have a dense culture, they tend to form bioflocs, containing bacteria, other organisms and organic particles. Mechanism of floc formation shows that the flocculation of microbial communities is a complex process. Within the floc's matrix, a combination of physical, chemical and biological phenomena is operating. The exact mechanisms and the methods to engineer microbiological flocs remain largely unknown [(3)]. The main constituents that can be found within the floc matrix are the extracellular polymeric substances. These structures form a matrix that encapsulates the microbial cells, and play a major role in binding the floc components together. The BFT maintains favourable water quality and enhance production in culture medium. The addition of substrates in BFT systems increased growth and further enhanced production, while also contributing to more favourable water quality conditions. According to the same study, growth and survival was not affected by stocking density (2500 vs 5000 PL/m2), therefore greater production outputs were achieved at the higher density. The *F. brasiliensis* post larvae grow similarly with or without pelletized feed in biofloc conditions during 30-d of nursery phase, which was 40% more than conventional clear-water continuous exchange system. Decrease FCR and reducing cost in feed. BFT has been also shown nutritional and zoo technical benefits. It was estimated that more than 29% of the daily food intake of *L. vannamei* consisted of microbial flocs, decreasing FCR and reducing costs in feed. The reference showed that juveniles of *L. vannamei* fed with 35% CP pelletized feed grew significantly better in biofloc conditions as compared to clear-water conditions. It was showed that controlling the concentration of particles in super-intensive shrimp culture systems can significantly improve shrimp production as well as aquaculture production and water quality[(4)]. Thus, this system is also called as active suspension ponds or heterotrophic ponds or green soup ponds.

Discussion:

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 culture system.

Conclusion

According to Biofloc technology in culture medium we are conclude that Carbon: Nitrogen ratio containing microbes are essential for floc formation. 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. The role of beneficial and useful micro-organisms in biofloc formation is a Eco-friendly culture system. It reduces environmental impact. Judicial use of land and water resources are 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. Microbes 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 Le, use of cheaper food fish and trash fish for fish feed formulation.

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