COPEFLOC TECHNOLOGY : A sustainable Aquamimcry Concept for Aquaculture

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Abstract

Copefloc technology is a novel approach in aquaculture that emulates natural ecosystems to generate copepod zooplankton blooms and beneficial microorganisms. Like biofloc systems, this technology offers sustainable shrimp and fish farming benefits by reducing production costs, improving water quality, and providing excellent nutrition. The technology involves adding probiotics to carbon sources like fermented rice bran, resulting in phytoplankton and copepod blooms. Copefloc is adaptable to semi-intensive and intensive aquaculture systems and provides numerous advantages, including reduced feeding frequency, lower production costs, improved water quality, disease resistance, and enhanced product quality. While it has many merits, its effectiveness in indoor culture systems is limited. In summary, cope-floc technology offers a sustainable and natural approach to aquaculture, paving the way for organic and pellet-free practices

Introduction

Copefloc technology is a recent concept in shrimp farming that aims to mimic the environment of a natural estuary by producing copepod zooplankton blooms and beneficial microorganisms that serve as live food and improve water quality in shrimp culture. Although this technology is similar to biofloc technology in some aspects, the amount of carbon absorbed is lower and less dependent on nitrogen input ratios. This article highlights the process and development of copefloc, merits and demerits of the technology.

Fig. 1. Microscopic image of copepod

Fig. 2. Imhoff cone Settlement of Copepod in Laboratory

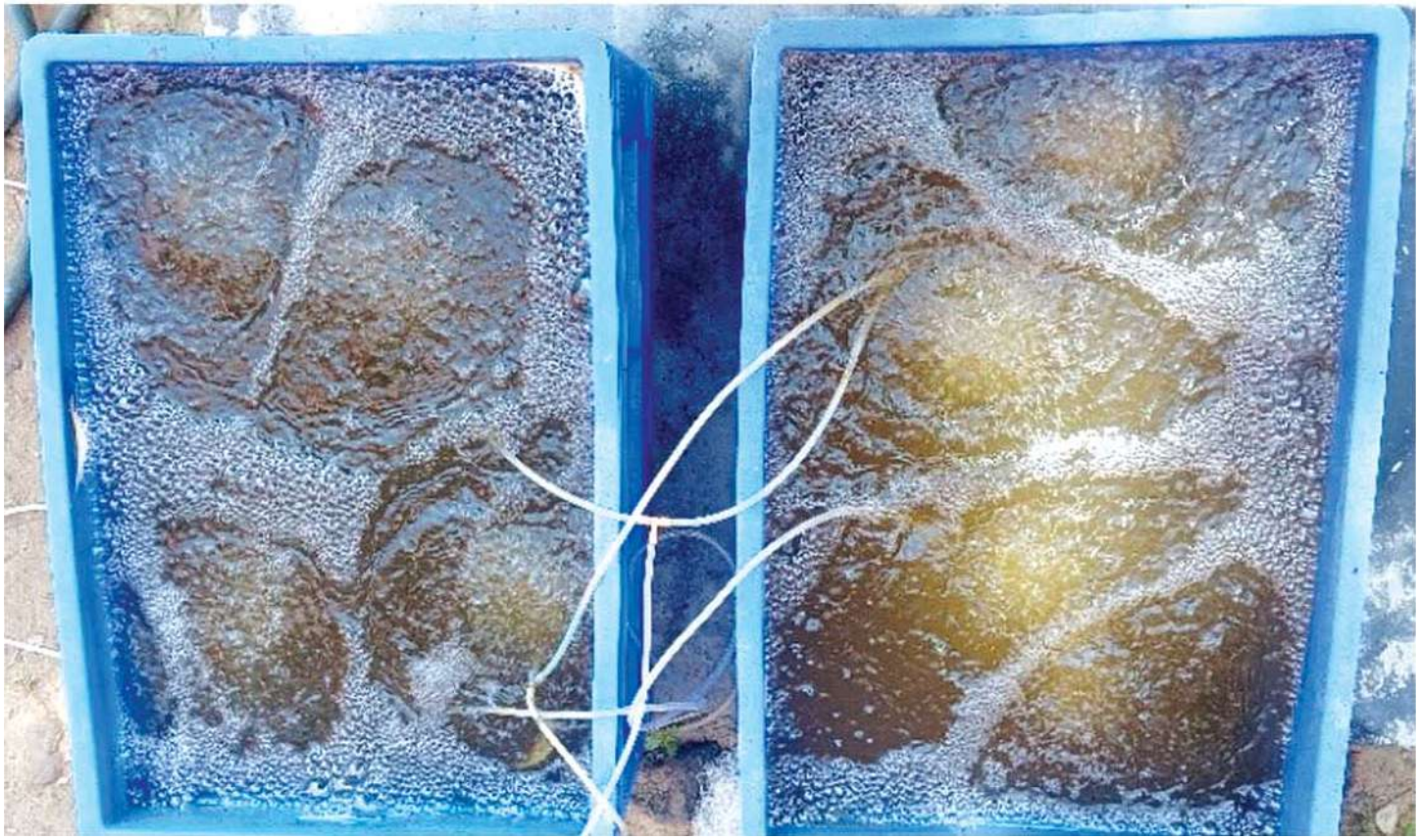

Fig. 3. Copepod bloom in the field

What is Copefloc ?

Copefloc technology is based on the aquamimcry concept, a novel idea first developed in Thailand. It involves *in-situ* waste absorption that resembles a natural ecosystem to generate zooplankton (copepod) blooms (**Fig. 1**) and promote the growth of beneficial bacteria to be made available that serve as an excellent source of nutrition for fish and shrimp in farming practices.

How to develop a copefloc system ?

Copefloc is produced by adding probiotics to a carbon source such as fermented rice bran (FRB) or wheat bran (FWB) to develop phytoplankton and zooplankton blooms. Fermented rice bran (FRB) is produced by adding probiotics to finely powdered rice bran and water at a ratio of 1:5 to 1:10 and allowed to ferment overnight. The fermentation process aids in the breaking down of anti-nutritional factors like fibre and phytic acid from the rice bran, making it favourable for the growth of copefloc. Rice bran, being a prebiotic source, combines with the probiotic added to establish a symbiotic effect. For the production of copefloc bloom in the fish and shrimp culture ponds (**Fig. 2**),

FRB can be applied at a rate of 500-1000 kg/ha. Within a week of application, the colour of the water turns golden brown, which indicates copefloc development in the system. To maintain copepod bloom, FRB can be incorporated every month at a rate of 10 kg/ha, along with probiotics to maintain the water quality.

Types of aquaculture systems suitable for the adoption of copefloc technology

Copefloc technology is suitable for semi-intensive and intensive fish and shrimp farming systems. A stocking density of 10 nos/m2 may be followed in fish farming. In shrimp farming, post larvae (PL 12-15) can be stocked at a density of 30-40 nos/m^2. FRB may be added at a dose of 1 ppm when the water turbidity is 30-40 cm (Secchi disc reading). In an experimental copefloc-based *Penaeus vannamei* culture, with a stocking density of 40 PL/m^2 a yield of 5.53 tons with a survival rate of 94% (CIBA 2021)

Important features of the copefloc system

Copepods are an excellent live feed for fish and shrimp as they are rich sources of protein, lipids, carbohydrates, and enzymes (exonuclease, esterase, protease, and amylase exonuclease, which are necessary for growth, larval survival, digestion, and metamorphosis. Furthermore, it has been noted that the copepods contain significant levels of carotenoids, peptides, free amino acids (such as taurine), vitamins, and minerals, including selenium, iodine, copper, and manganese, which provides a characteristic red colour, increasing the market potentiality. In addition, copepods can withstand a wide range of environmental fluctuations. To retain the zooplankton as a feed and to create minimal biofloc of <25 mL/L (Imhoff cone reading) FRB at a rate of 1ppm/day throughout the culture period (**Fig. 3**). The copefloc development not only meets the nutritional requirements of the cultured fishes but also lowers the feeding interval from thrice to twice a day and proportionate costs involved for the feed which generally constitutes about 50-60% of the production costs in intensive farming practices.

Benefits

Copefloc technology is suitable for adoption in fish and shrimp culture practices due to the following benefits.

- ü The overall production costs for the fish/shrimp culture are reduced as there is no exogenous feeding.
- ü Copefloc technology does not require any filtration system, and the water exchange is minimized as excess sediment is removed.
- ü The water quality issues are reduced due to pollution in the pond bottom, viz., black soil formation and odour related to overfeeding and high protein feed.
- ü Disease incidence is reduced as live feed forms are considered nutrient capsules rich in vitamins that are known to improve the overall health disease resistance in fish/ shrimp at a higher risk in the intensive culture systems.
- ü Copefloc also improves the colour and attractability of cultured fish and shrimp as they are rich in amino acids, polyunsaturated fatty acids, and astaxanthin, imparting red to the skin and flesh.

However, implementing this concept in indoor culture systems is less effective.

Conclusion

Owing to the various advantages over traditional farming practices, copefloc technology is more sustainable for developing organic shrimps by incorporating natural inputs eliminating the use of any hazardous chemicals or antibiotics to yield nutritious and safe products to the consumers. Copefloc technology will also pave the way for pellet-free aquaculture practices, increasing its sustainability.