

sludge at harvest time, etc. There is not a single universal set of guidelines that can be followed, i.e. a recipe, for the production of biofloc. There are, however, some consistent features of these systems and understanding what they are and ensuring that the system is conducive to the formation of these particulate materials will go a long way towards ensuring that a degree of reproducibility is achieved.

- High biomass. High animal densities result in higher nitrogen levels from faecal material and feed waste that diffuse into the water from the feed prior to it being consumed. Particularly in the case of shrimp, these are added to the water column because of the way the shrimp feeds.
- Aeration. Vigorous aeration is required to keep the particles in suspension and to encourage their formation.
- Ratio of carbon to nitrogen. These range from about 10:1 to 20:1. The ratio has to be determined experimentally for each operation. Flocs do not form immediately and typically, the addition of molasses or other soluble carbon sources is needed to optimise conditions for biofloc formation.
- Consumption by fish/shrimp. The ability of the organisms being produced in these systems to consume the particulates. In order to prevent the accumulation of these materials from becoming rate limiting they must be removed from the system. Clearly the solution that makes the most sense is when they are eaten by shrimp (*Litopenaeus vannamei* or other omnivorous benthic grazing species) and fish (Tilapia species, some catfish species, etc.). Any other method for removal would add costs that might not be acceptable.
- Diet reformulation. Sources of sulphur in the diets and diet formulations that are not consistent with the buildup of toxic levels of micronutrients. In any system, that is largely if not completely closed, it is critical that diet formulations take this into account or the system can crash from the accumulation of metals and other potential inhibitory materials.

Useful but....

In conclusion, the production of suspended particulate biofloc in aquatic production systems is a very useful tool for improving profitability, biosecurity and lessening the environmental footprint of aquaculture. It enhances sustainability and the eco-friendly nature of aquaculture.

Not all systems lend themselves to this approach. For those that do, generation of these high nutritious and water chemistry moderating amalgams of organisms and nutrients are an essential element of a responsible and consistent production system.



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