Bioremediation of wastewater by bioflocculant technology in aquaculture

The shrimp farming industry is expanding rapidly， accounting for 15% of internationally traded seafood. For decades， the increase in world shrimp production has relied primarily on traditional， crude farming methods， but more recently， industry expansion has focused on intensification. The rapid expansion of the industry has stimulated the intensification of production systems.

However， intensive farms face several obstacles that hinder further development. They rely on relatively high rates of water exchange to flush away waste， maintain water quality， regulate plankton density， and introduce supplemental food organisms. However， water exchange poses a potentially catastrophic disease risk， as well as pumping costs and environmental impacts due to eutrophication of the receiving water body and biological entrainment of source water.

In addition， shrimp wastewater management is an international issue， present in all corners of the world. In view of this， the concept of recycling and reuse is appearing

everywhere. In addition to this， effluents discharged from aquaculture farms are reported to contain more nutrients than other industries. The organic load in the water can be used to produce horticultural plants. This aquatic effluent contains bioavailable nitrate nitrogen，ammonia in ionic form and organic nitrogen， which are obtained through the conversion of ammonia and are important for the cultivation of various fruit plants.

In aquaculture， especially shrimp farming， the reuse or recycling of wastewater is an important pollution and high quality shrimp production. With modern technologies， such as recirculating aquaculture systems (RAS)， it is possible to reuse solids discharged from aquaculture wastewater. In addition， another advanced aquaculture system is the closed raceway system (CRWS)， which reduces water consumption and also reduces wastewater discharge. Various fish species， such as tilapia and shrimp， can be effectively farmed in these systems using waste， so that only a portion of the sludge is released into the environment.

The effluent of modern aquarium systems such as RAS and CRWS consists mainly of manure， unconsumed feed， inorganic nitrogen and phosphorus， which are potential organic fertilizers that support plant production through aquaponics systems. For these reasons， a system called bioflocculant was developed which actually treats the wastewater from intensive systems. It encourages a reduction in solids discharge to the environment by keeping organic solids in suspension， which helps control ammonia in aquatic systems. However， total solids should also be kept under control. Excess solid waste is removed periodically to maintain the required C:N ratio in the CRWS system. Excess solid waste can also be discharged into the aquaponic plants. Bioflocculants influence the active growth and production of shrimp larvae， in addition to providing more favorable water quality conditions， regardless of stocking density. intensive broodstock of Litopenaeus vannamei driven by aerobic microbial flocculants (AMF) offers great production potential in low salinity raceway systems.

Reduced or zero water exchange is also considered as a biosecurity measure as it prevents the entry of diseases from the outside. The biofloc system itself convinces the association of solid waste and bacteria in the system and keeps them suspended in an aerobic environment by intensive aeration.

What is bioflocculant?

Bioflocs are assemblages of animal manure， waste feed， plant and animal plankton，and bacterial communities. Flocs are microscopic and macroscopic in size and light in weight. Flocculent has good nutritional value， ranging from 20-45% protein and 1-5% fat in the dry state (Hargreaves， 2013). In addition， it contains various minerals and vitamins and can be used as a natural probiotic rather than external inoculation. It can also be used as an aquafeed ingredient in dry form. When there is no aeration， the floc can easily settle at the bottom of the tank， which facilitates the removal of excess sludge from the system.