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**Project title: Application research of nano babbles in the culture of shrimps**

Aquaculture is the fastest-growing food industry sector worldwide and has now surpassed capture fisheries production and its further growth is expected. Shrimp farming is one of the forms of aquaculture which began centuries ago in Asia and is farmed around the world. World shrimp production went up to about three million tons in the last 20 years. This was made possible by the intensification of shrimp culture by way of high stocking density. However, higher stocking densities induce problems such as decreased oxygen levels and poor water quality events, which in turn have been shown to cause lowered survival, growth as well as increases in cannibalism. Therefore, successful shrimp production requires innovations in technology and management of water quality.

Nanobubbles were approved to have a high potential in improving water quality, reducing energy costs, and promoting fish (*e.g.* Nile tilapia, *Oreochromis niloticus*, rainbow trout, *Oncorhynchus mykiss*) growth compared to existing methods of oxygenation or ozone application. Nanobubbles are defined as small gas bubbles with a diameter of less than 100–200 nm, they have neutral buoyancy, which enables them to have a long residence time (several hours) in the water. This happens due to changes in the size of nanobubbles from micro to nano-size by the diffusion of gas from inside the bubble to the liquid around the bubbles so that the size of the bubbles decreases to nano size. Electrolyte ions around the bubble will compress the gas molecules around the bubble so that the process of gas diffusion from the bubbles to the liquid will be constrained.

This study aimed to apply a novel type of aerator called Nano Bubble Generator (NBG) for marine/brackish whiteleg shrimp in intensive culture. The impact of different nanobubbles concentrations on shrimp culture performances will be tested. The NBG will be run based on the principle of a venturi tube in which water will be circulated through a narrowed channel so that air was sucked into the device and pushed by the flowing water to create a nano-sized bubble. The water quality parameters, fish behavior including growth parameters, and the level of cannibalism will be observed for 3 weeks.

**Possible learnings and outcomes**

• Application of Nano Bubble Generator in terms of aquaculture

• Data analysis on shrimps culture performances

• Possible collaboration in a joint publication