

Case Study

Advanced Disease Control in Aquaculture Using NICO Ozone Nanobubble Technology



Overview

Disease outbreaks in aquaculture are primarily driven by poor water quality, microbial contamination, and oxidative stress. Conventional treatment methods often rely on chemicals or antibiotics, leading to increased costs, resistance risks, and environmental concerns.

This case study, conducted in collaboration with the Kerala University of Fisheries and Ocean Studies (KUFOS), evaluates the role of NICO Nanobubble Technology in improving water quality, reducing microbial stress, and enhancing fish health through controlled oxidative and oxygenation mechanisms.

Project Details

- **Institution:** Kerala University of Fisheries and Ocean Studies (KUFOS)
- **Application:** Aquaculture Health & Disease Control (Tilapia Culture)
- **Technology:** NICO Nanobubble System (O₂/O₃ Integrated Approach)
- **Operational Mode:** Periodic nanobubble treatment cycles
- **Study Duration:** 3 Months
- **Comparison:** Conventional System vs Nanobubble Treatment



Significance of Disease Control Systems

- Disease outbreaks can result in 20–50% production loss, making them one of the biggest risks in aquaculture
- Poor water quality acts as a breeding ground for pathogens, accelerating infection cycles
- Elevated stress levels directly suppress immunity, increasing mortality and disease susceptibility
- Accumulation of ammonia and organic waste creates toxic conditions that trigger disease outbreaks
- Conventional dependence on antibiotics leads to resistance, regulatory challenges, and long-term inefficiency
- Uncontrolled microbial activity results in unstable systems and unpredictable yield performance
- Reactive treatment approaches increase operational costs without addressing root causes
- Effective disease control ensures stable water conditions, lower pathogen load, and resilient aquatic health
- Preventive systems enable consistent production, higher survival rates, and improved feed efficiency
- Strong disease management directly translates into higher yield, reduced losses, and better profitability

NICO Nanobubble Solution

NICO's nanobubble-based system capable of delivering oxygen and oxidative conditions (via controlled ozone integration) to improve water hygiene and fish health.

Key functional advantages:

- **Microbial Reduction:** Oxidative action helps suppress harmful bacteria and pathogens
- **Ammonia Control:** Maintains ammonia levels below toxic thresholds for extended durations
- **Stress Reduction:** Improved water conditions reduce physiological stress in fish
- **Enhanced Water Clarity:** Reduction in biofilm and suspended contaminants
- **Sustained Treatment Effect:** Nanobubbles remain active in water, enabling prolonged interaction

The system ensures non-invasive, chemical-minimized disease control, improving both water and biological health simultaneously.



Performance Outcomes

Parameter	Unit	Conventional System	NICO Nanobubble System
Microbial Load	-	High	Significantly Reduced
Cortisol Levels (Stress Indicator)	mg/mL	< 20	< 10
Ammonia Levels	mg/L	Fluctuating / Elevated	Controlled (stable up to 8 h)
Oxidative Stress Markers	-	Higher	Reduced (AChE, SOD, CAT, GPx)
Fish Health	-	Stress-prone	Improved immunity & resilience
Water Clarity	-	Moderate / Biofilm present	Improved clarity, reduced biofilm

Impact Analysis

The integration of nanobubble-based oxidative treatment resulted in substantial improvements in fish health and disease resistance:

- **Reduced Disease Risk:** Lower microbial load minimized infection probability
- **Improved Fish Immunity:** Reduced oxidative stress enhanced physiological resilience
- **Lower Mortality Potential:** Healthier aquatic environment supports survival rates
- **Reduced Chemical Dependency:** Minimizes the need for antibiotics and chemical dosing
- **Stable Water Quality:** Controlled ammonia and improved clarity reduce pathogen growth
- **Enhanced Operational Sustainability:** Promotes eco-friendly and compliant aquaculture practices

Conclusion

The study demonstrates that NICO's nanobubble technology, when applied with oxidative capability, offers an effective and sustainable solution for disease control in aquaculture systems. By simultaneously improving water quality, reducing microbial stress, and enhancing fish immunity, the technology provides a holistic approach to aquatic health management.

This positions nanobubble technology as a next-generation alternative to chemical-based disease control strategies in aquaculture.