Ammonia and Dissolved Oxygen Maintaining System for Shrimp Farming

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Abstract

Shrimp aquaculture is a key industry in Sri Lanka, contributing significantly to nutrition, employment, poverty reduction, and foreign exchange. However, a decline in shrimp production rates has been observed due to factors such as rapid population growth, environmental pollution, and climate change, negatively impacting the freshwater shrimp sector. Though managing the water quality parameters can enhance production, little attention has been given to innovative water quality management strategies in shrimp farms. Traditional monitoring systems in shrimp farms are outdated, time-consuming, and lack real-time functionality, making it difficult to maintain optimal water conditions. To address this issue, our study presents a real-time monitoring system for freshwater shrimp farms. The system integrates microcontroller-based devices and visualization tools to continuously monitor key water metrics such as pH and dissolved oxygen levels. The system activates when DO levels drop below 6.5 ppm or when pH values exceed 8.25, as per optimal shrimp farming conditions. Conversely, it remains inactive when pH levels fall below 7.5 or DO levels rise above 8.25 ppm. The system operates based on fuzzy logic rules, adjusting to the varying pH and DO levels to maintain water quality within the optimal range. The system includes an automated mechanism for deploying anti-ammonia tablets when water quality deviates from safe thresholds. During nighttime, when oxygen levels naturally drop, the system monitors dissolved oxygen concentrations and activates tractor-powered emergency aerators if levels fall below acceptable limits. Small-scale aeration systems are also integrated into hatcheries, ensuring adequate oxygen supply throughout the shrimp lifecycle. This real-time automated system improves shrimp farming efficiency by optimizing water quality and reducing manual intervention. Although designed for large-scale operations, testing in a smaller tank limits insights into its scalability. Future research should focus on enhancing tank design to better remove waste and improve shrimp health.

Keywords: *Shrimp Aquaculture, Real-time Monitoring, Water Quality Management, Fuzzy Logic Control, Automated aeration*

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