A Nano-Chitin and HACC Multilayer System for Remediating Severely Eutrophic Waters via Oxygenation, Bacterial Inhibition, and Nutrient Stabilization

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Restoring severely eutrophic waters, especially in hardened urban river channels, is challenging and costly due to algal blooms, turbidity, microbial overgrowth, oxygen depletion, and nutrient accumulation. Current treatment approaches, including ecological restoration and engineering-based hardening, often require substantial financial investment and may remain ineffective under heavily polluted conditions. In order to address these limitations, the present project develops an integrated nano-chitin-based remediation system. Nano-chitin, prepared by high-pressure homogenization, exhibits improved dispersibility, flocculation capacity, and antibacterial performance compared with ordinary chitin. In addition, nano-chitin and HACC show synergistic effects at low concentrations in promoting flocculation and providing longer-term algae-inhibiting and antimicrobial effects. On this basis, a multilayer oxygen-releasing tablet is designed by combining nano-chitin, HACC, and coated sodium percarbonate, so that suspended particles and algae can be flocculated, problematic microbial growth can be inhibited, and dissolved oxygen conditions can be improved. The tablet is further combined with a modular floating basket containing Acorus calamus for nitrogen and phosphorus uptake, while a monitoring device is designed to support routine algal observation. In a 4-week simulated algal bloom treatment process, the system effectively clarified water, reduced nitrogen and phosphorus levels, and suppressed algal growth over time. Together, these results indicate that the system provides a long-term, effective, environmentally friendly, and potentially scalable treatment strategy for bloom-prone severely eutrophic waters.

Awards Won:

Second Award of $2,400