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ENHANCING URBAN WASTEWATER TREATMENT: THE ROLE OF WINTER AQUATIC PLANTS IN ECOLOGICAL FLOATING BEDS

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Abstract

This study examines the efficiency of various aquatic plants in ecological floating beds for the remediation of municipal wastewater treatment plant tailwater under winter conditions. Twelve aquatic species were selected for investigation, with a focus on their individual and combined abilities to improve tailwater quality. Notable increases in biomass were observed in eight species, namely *Acorus calamus*, *Alisma orientalis*, *Water celery*, *Reed*, *Umbrella grass*, *Scirpus validus*, *Iris*, and *Thalia Dealbata*, while *Canna indica*, *Pontederia cordata*, *Loosestrife*, and *Cattail* demonstrated lesser growth. Tailwater pH levels treated with these plants showed a decreasing trend initially, followed by an increase, yet remained lower compared to the untreated control. Significant reductions were recorded in nitrogen, phosphorus, and Chemical Oxygen Demand (COD) levels. Specifically, *Scirpus validus* exhibited the highest removal rates for Total Nitrogen (TN) and Ammonium Nitrogen ($\text{NH}_4^+\text{-N}$) at 70.3% and 80.6% respectively, *Canna indica* was most effective in Total Phosphorus (TP) removal with a 73.8% rate, and *Thalia Dealbata* achieved the highest COD reduction at 36.3%. The study identifies *Scirpus validus*, *Thalia dealbata*, *Canna indica*, and *Iris* as particularly suitable for winter application in municipal wastewater treatment. Furthermore, a synergistic effect was observed in mixed plantings, especially combinations of *Iris* with *Scirpus validus* or *Thalia dealbata*, leading to enhanced biomass and more efficient pollutant removal. This mixed planting strategy compensates for the varying pollutant removal efficiencies of individual species, thereby optimizing the remediation process. The findings underscore the potential of using a diverse array of aquatic plants in ecological floating beds to enhance the quality of wastewater tailwater, particularly under winter temperature conditions.

Key words: aquatic plants, ecological floating beds, municipal wastewater, nitrogen and phosphorus removal, tailwater treatment, winter conditions

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