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CARBON, NITROGEN AND PHOSPHORUS REMOVAL EFFICIENCY AND BACTERIAL RESPONSE MECHANISM IN WUHE CONSTRUCTED WETLAND, SHANDONG PROVINCE, CHINA

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Abstract

This study investigates bacterial-driven nutrient removal mechanisms in Wuhe constructed wetland after ten years of operation. The results demonstrate markedly limited nitrogen and COD_{Cr} removal but sustained phosphorus efficiency, linked to distinct bacterial communities between water and sediment environments. The bacteria communities in water samples (dominated by *Proteobacteria*, *Actinobacteriota* and *Firmicutes*) showed lower diversity than sediment bacterial communities (enriched with unique *Chloroflexi*, *Bacteroidota* and *Acinetobacter*). Nitrogen removal was constrained by carbon limitation (C/N = 1.55–2.09), restricting denitrifier activity despite their presence, while COD_{Cr} removal declined due to the inputs of refractory organics. In contrast, phosphorus retention relied heavily on sediment adsorption (e.g., iron/aluminum oxides). These findings highlight the need for targeted carbon supplementation and sediment management to optimize long-term wetland performance, offering practical strategies to enhance nutrient removal in aging constructed wetlands.

Key words: bacterial community, constructed wetlands, nutrient removal efficiency, RDA analysis

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