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Sulfamethoxazole Removal and Ammonium Nitrogen Conversion by Microalgae-Bacteria Consortium in Ammonium-Rich Wastewater: Responses Analysis

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Abstract : In the treatment of ammonium-rich wastewater with 500 µg/L sulfamethoxazole (SMX) antibiotic by a Microalgae-Bacteria Consortium, diverse parameters were monitored to assess treatment efficacy. Over 14 days, residual SMX concentrations decreased markedly from 500 µg/L to 45.6 µg/L, and removal rates declined from 102.4 to 9.9 µg/L/day. Biomass exhibited consistent growth, reaching a peak of 542.6 mg/L on day 10. Chlorophyll-a, chlorophyll-b, and carotenoid levels varied over time, reflecting fluctuations in microalgal activity. Extracellular polymeric substances (EPS) production showed temporal variations, with protein content ranging from 69.4 to 162.3 mg/g Dry cell weight (DCW) and polysaccharides content from 50.6 to 82.8 mg/g DCW. Ammonium nitrogen concentration decreased steadily from 300 mg/L to 5 mg/L throughout the treatment period. The bacterial community composition was significantly altered in the presence of antibiotics, with notable increases in Bacteroidota and Proteobacteria. Community richness and diversity indices were higher in the antibiotics-treated group than in the control group, as evidenced by the Chao index (258 compared to 181), Shannon index (1.8085 compared to 1.1545), and Simpson index (0.5032 compared to 0.6478), indicating notable shifts in microbial community structure. These findings demonstrate the efficacy of the Microalgae-Bacteria Consortium in removing SMX from wastewater and suggest its potential to mitigate antibiotic pollution while maintaining microbial diversity.

Keywords : ammonium-rich wastewater, microalgae-bacteria consortium, sulfamethoxazole removal, microbial community diversity, biomass growth
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