OPTIMIZATION OF OPERATIONAL CONDITIONS FOR NITRITE ACCUMULATION IN A SUBMERGED BIOFILTER

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Abstract

The partial nitrification bioreactor (PNBR) was operated at a constant temperature and an influent synthetic wastewater pH of 35°C and 8.5, respectively. The effects of dissolved oxygen concentrations (DO), hydraulic retention times (HRT), and the nitrogen loading rates (NLR) on the ammonium removal efficiencies and the NO₂⁻/NO₃⁻ ratio were investigated. The activity of nitrite oxidizing bacteria was stimulated at high DO concentrations. The highest NO₂⁻/NO₃⁻ ratio of 0.76 was obtained at the DO concentrations of 1.9 mg/L. The NLRs and HRTs significantly affect the NO₂⁻ accumulation in the PNBR. Although the most of NH₄⁺ (98%) was oxidized at the HRT of 10.3 h, the ratio of NO₂⁻/NO₃⁻ [NO₂⁻/ (NO₂⁻+NO₃⁻)] was too low (0.33). The removal efficiency of NH₄⁺ decreased to 92% while the ratio of NO₂⁻/NO₃⁻ achieved the highest level of 0.76 under the operational conditions. However, the removal efficiency of NH₄⁺ decreased from 94% to 92%. Further increased the NLR caused the deterioration of NH₄⁺ oxidation and NO₂⁻/NO₃⁻ ratio. The stable NO₂⁻ production rate of about 810 g/m³.day (2.5 g/m².day) was obtained under the NLR and surface loading rate of 830 g NH₄⁻ /m³.day and 3.55 g/m².day, respectively.

Keywords: DO, HRT, NLR, NO₂⁻/NO₃⁻ ratio, partial nitrification

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