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"Gheorghe Asachi" Technical University of Iasi, Romania

OPTIMIZATION OF OPERATIONAL CONDITIONS FOR NITRITE ACCUMULATION IN A SUBMERGED BIOFILTER

Sukru Aslan*, Erdal Simsek

Cumhuriyet University, Engineering Faculty, Department of Environmental Engineering, 58140, Sivas/Turkey

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 NO_2-N/NO_x-N ratio were investigated. The activity of nitrite oxidizing bacteria was stimulated at high DO concentrations. The highest NO_2-N/NO_x-N ratio of 0.76 was obtained at the DO concentrations of 1.9 mg/L. The NLRs and HRTs significantly affect the NO_2-N accumulation in the PNBR. Although the most of NH_4-N (98%) was oxidized at the HRT of 10.3 h, the ratio of NO_2-N/NO_x-N [NO_2-N/ (NO_2-N+NO_3-N)] was too low (0.33). The removal efficiency of NH_4-N descended to 92% while the ratio of NO_2-N/NO_x-N achieved the highest level of 0.74 at the HRT of 5.2 h. At the NLR of 830 g NH_4-N/m^3.day, the ratio of NO_2-N/NO_x-N reached to the highest level of 0.76 under the operational conditions. However, the removal efficiency of NH_4-N decreased from 94% to 92%. Further increased the NLR caused the deterioration of NH_4-N oxidation and NO_2-N/NO_x-N ratio. The stable NO_2-N production rate of about 810 g/m^3.day (2.5 g/m^2.day) was obtained under the NLR and surface loading rate of 830 g NH_4-N /m^3.day and 3.55 g/m^2.day, respectively.

Keywords: DO, HRT, NLR, NO_2-N/NO_x-N ratio, partial nitrification

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* Author to whom all correspondence should be addressed: e-mail: saslan@cumhuriyet.edu.tr; Phone:+903462191010-1296; Fax: +903462191177