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Enhanced nitrogen removal and energy saving of intermittent aeration-modified oxidation ditch process

Bo-Lin Li[a,b,c,*], Zhi Zhang[c,d], Ye Li[a,b], Meng-Ting Song[a,b], Chi Zhang[c,d]

[a]*School of Resources and Environmental Engineering, Wuhan University of Technology, Wuhan 430070, China Tel. +86 13886099366; email: bolly1221@163.com*
[b]*Key Laboratory of Hubei Province for Mineral Resources Processing and Environment, Wuhan 430070, China*
[c]*Faculty of Urban Construction and Environmental Engineering, Chongqing University, Chongqing 400045, China*
[d]*Key Laboratory of the Three Gorges Reservoir Region's Eco-Environment, Ministry of Education, Chongqing 400045, China*

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ABSTRACT

To enhance the removal effect of nitrogen from municipal wastewater and to reduce the operating energy consumption of an oxidation ditch, a modified carrousel oxidation ditch, which established the selection zone, the anaerobic zone, and the anoxic zone, was chosen for study. In addition, the nitrification rate, denitrification rate, and effluent quality were chosen as feasibility criteria, and the operating conditions of intermittent aeration were optimized in a pilot-scale experiment and studied during productive debugging. The results showed that intermittent aeration can enhance the nitrogen removal effect and reduce energy consumption. The characteristic feature of the internal reflux of the modified carrousel oxidation ditch without power consumption was fully utilized, the flow rate in the main reaction zone became large, and the internal reflux flow was increased by enlarging the opening of the internal reflux valve appropriately during the aeration stage. In addition, the pre-anoxic zone was used for nitrogen removal. In the stop aeration stage, the flow rate in the main reaction zone became smaller and the internal reflux flow decreased. The main reaction zone and the anoxic zone together were used for nitrogen removal. In the operating conditions in which there is 1 h of aeration and 2 h of non-aeration, the internal reflux ratio was 195–235% in the aeration stage compared with 55–105% in the non-aeration stage. The effluent COD and NH_4^+-N can meet the discharge standard consistently. Compared with the continuous aeration condition, the effluent total nitrogen in the intermittent aeration condition decreased from 16–27.6 to 9–15 mg/L, the average removal rate increased from 50.5 to 72.8%, and the average power consumption decreased by 30.9%.

Keywords: Carrousel oxidation ditch; Intermittent aeration; Nitrification rate; Denitrification rate; Nitrogen removal

*Corresponding author.