Optimization of BNR from Wastewater Using SBR and A^2O Processes

by

Guo, Lei (Eric)

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University of Macau

CONTENT

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ABSTRACT

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Guo, Lei (Eric)

Thesis Supervisor: Prof. Shim, Hojae

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Comparative study of biological nutrient removal (BNR) in lab-scale SBR (sequencing batch reactor) and A^2O (anaerobic/anoxic/oxic) reactor was conducted using synthetic and real wastewater. In synthetic wastewater test, the effects of HRT (hydraulic retention time), as an operating parameter, and some characteristics of influent wastewater, such as COD (chemical oxygen demand)/TP (total phosphorus) (C/P) ratios and chloride concentrations were investigated for the two processes. The optimum performance of the two reactors was both realized at 13.8-h HRT. Relatively higher TN (total nitrogen) and TP removal efficiencies were observed in the SBR. Adverse effect of influent C/P ratio on phosphorus removal was observed in both reactors. The highest TP removal efficiencies in the two processes were realized with influent C/P ratio of 200, at 91.0 and 83.3%, respectively. As PAOs (phosphorus accumulating organisms) competed with denitrifiers for external carbon source, nitrogen removal was affected with influent C/P ratios lower than 80 in A^2O process. Excellent COD removal (higher than 95%) was always achieved for different influent C/P ratios in the two reactors. Organic and nutrient removal was obviously affected by the changing of influent Cl^- concentration from 150 to 5,000 mg/L in both reactors. COD removal efficiency decreased linearly from 96.4 and 94.8 to 48.4 and 63.0% for SBR and A^2O reactor, respectively, with the increase of chloride concentration from 95 to 5,000 mg/L. Regarding nitrogen removal, only nitrification process was influenced when 5,000 mg/L chloride was introduced into the influent of SBR. Phosphorus removal was negatively affected when influent chloride concentrations were higher than 1,500 mg/L, and effluent TP concentration kept increasing with

further increase of influent chloride concentration. In real wastewater test, percentages for COD, BOD_5 (biochemical oxygen demand), NH_3-N, TN, and TP removals were averaged at 88.6, 97.5, 89.3, 82.7, and 71.5%, respectively, for SBR process, while the values were 86.0, 97.5, 88.9, 84.7, and 67.5, respectively, for A^2O process. The effluent from SBR and A^2O processes can almost meet the wastewater discharge permit of China (1st grade B), except for a little higher effluent TP concentrations. There is a great potential to upgrade the UNITANK and traditional activated sludge processes to SBR and A^2O systems for advanced wastewater treatment in Taipa and Macau plants, respectively.