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OPTIMIZATION CONDITIONS AND APPLICATION OF MOVING BED BIOFILM REACTOR FOR MATURE LANDFILL LEACHATE TREATMENT

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Abstract

Moving bed biofilm reactor (MBBR) technique is a useful technology for the treatment of mature landfill leachate. The reactor start-up and acclimation processes illustrated that many factors, such as biomass, C/N ratio, and influent volumetric loading rates, could affect the ammonium-nitrogen (NH₄⁺-N) and COD removal. The factorial experiments were carried out to determine the optimal reactor operational conditions, and the results demonstrated that when DO 2-4 mg/L, pH 7.5, and hydraulic retention time (HRT) 16 h, the high removal efficiencies of NH₄⁺-N and COD would be achieved at 0.2-0.25 kgNH₄⁺-N/m³•d of influent NH₄⁺-N volumetric loading rate and 0.6-0.8 kgCOD/m³•d of influent COD volumetric loading rate, respectively. To achieve the effective removal of NH₄⁺-N or COD at optimal conditions, the effluent reflux ratio would be controlled to obtain proper influent NH₄⁺-N or COD volumetric loading rates; to simultaneously achieve the effective removal of NH₄⁺-N and COD at optimal conditions, influent volumetric loading rates and C/N ratios would be properly taken; moreover, proper amounts of extra nutrients would be added to promote the growth and activity of microorganisms in the treatment processes. Stable short-cut nitrification with high nitrosation rate and low nitrate-nitrogen concentration could be achieved at the conditions of low DO concentration, moderate pH value, and low C/N ratio. Moreover, controlling different operational conditions could achieve the accumulation of different concentrations of nitrite, and then different subsequent biological processes would be applied for the effective removal of NH₄⁺-N.

Key words: mature landfill leachate, moving bed biofilm reactor, optimization, reactor acclimation, short-cut nitrification

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