Microbial community dynamics in hybrid biological reactor treating petrochemical wastewater

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ABSTRACT

Hybrid biological reactor (HBR) was developed by adding carriers to the aeration tanks, and could be applied to improve the poor nitrification ability of overloaded petrochemical wastewater treatment plants. Using the normal activated sludge process (ASP) as a control, the performance of ASP combined with HBR for the treatment of petrochemical wastewater was studied. When the influent load was 0.97 kg CODCr/m³ d (CODCr, Chemical Oxygen Demand with the oxidant of K2Cr2O7), effluent of ASP contained 138.2 mg/L CODCr and 8.2 mg/L NH₄⁺-N, and the CODCr and NH₄⁺-N concentration in effluent of HBR was 120.8 and 1.6 mg/L, respectively, indicating that both processes had good removal capacities for petrochemical wastewater. When the load was increased to 1.94 kg CODCr/m³ d, there was no apparent change in effluent CODCr values of HBR and ASP. However, a great difference in the removal efficiency of NH₄⁺-N between HBR and ASP was observed. NH₄⁺-N concentration in effluents of ASP and HBR was 16 and 1.7 mg/L, respectively, suggesting that HBR had a much better treatment capacity for NH₄⁺-N than ASP. Using ribosomal intergenic spacer analysis fingerprinting and 16S rDNA sequence analysis, a big difference in microbial community structure was found between the two processes. And there existed simultaneous nitrification and denitrification in HBR system. Compared with ASP, HBR had more advantages, such as high utilization of oxygen, less sludge generation, and lower power consumption.

Keywords: Petrochemical wastewater; Hybrid biological reactor; Organic loading rate; Nitrification; RISA

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