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厌氧水解酸化处理含高浓度聚丙烯酰胺污水

Treatment of wastewater containing high concentration of partially hydrolyzed polyacrylamide by anaerobic hydrolytic acidification

关键词：厌氧 HPAM污水 厌氧折流板反应器 降解率

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摘要：运用厌氧瓶和厌氧折流板反应器（ABR）对含部分水解聚丙烯酰胺（HPAM）的污水进行厌氧水解酸化生物处理.选取PAM-F1和PM-2两株厌氧菌为HPAM降解菌，并优化了单株菌和混合菌的降解条件.结果发现，最佳降解条件为降解9 d，连续活化3次，温度35~40℃，初始pH=7.5.此时，混合菌对500 mg·L^{-1} HPAM污水的降解效果最好，降解率可达到40.69%.通过生理生化特征和16S rDNA分析，确定PAM-F1为红球菌（*Rhodococcus* sp.）.混合菌降解前后的HPAM傅里叶-红外光谱图分析表明，细菌能够降解并利用HPAM的部分胺基和碳作为生长所需的氮源和碳源，并推断出HPAM的降解过程发生在厌氧水解酸化阶段.扫描电镜（SEM）图片显示，ABR中形成了能有效促进HPAM生物降解的颗粒污泥.而经过ABR处理的HPAM污水，COD_{Cr}去除率和HPAM降解率可分别达到89.96%和75.48%.研究表明，厌氧水解酸化法是一项能够有效处理含高浓度HPAM污水的技术.

Abstract: Anaerobic bottles and ABR were applied for biological treatment of wastewater containing high concentration of partially hydrolyzed polyacrylamide (HPAM) based on anaerobic hydrolytic acidification. Two strains of anaerobic bacteria named PAM-F1 and PM-2 were selected to degrade HPAM and the degradation conditions of single and mixed strains were optimized. The optimum degradation conditions included 9-day degradation and 3-time continuous activation under 35~40℃ with initial pH 7.5. Under these conditions, the mixed strains had the best degradation effect on wastewater with concentration of HPAM up to 500 mg·L^{-1}, and the degradation rate reached 40.69%. PAM-F1 was identified as *Rhodococcus* sp. by 16S rDNA sequencing and physiological and biochemical characteristics. Fourier transform infrared (FT-IR) analysis of HPAM samples before and after biodegradation indicated that the microorganisms could degrade HPAM and utilize part of its amidogen and carbon as the sole source of carbon and nitrogen for their growth, and the degradation of HPAM happened in anaerobic hydrolytic acidification process. Image of scan electronic microscopy (SEM) showed that granular structure of sludge was formed in ABR which promoted bio-degradation of HPAM significantly. After treatment of ABR, removal rate of COD_{Cr} and degradation rate of HPAM were 89.96% and 75.48% in the wastewater with HPAM, respectively. Generally, the anaerobic hydrolytic acidification method was proven as a high efficiency technique for treating wastewater with high concentration HPAM.

Key words: anaerobic HPAM wastewater ABR biodegradation efficiency

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