

Combined System for Biological Removal of Nitrogen and Carbon from Nylon₆ Production Wastewater

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Abstract A combined system consisting of hydrolysis acidification, denitrification and nitrification reactors was used to removal carbon and nitrogen from the nylon₆ production wastewater. The effects of circumfluence ratio and DO concentration on the system performance were analyzed. Results showed that when the circumfluence ratio was 3, DO of the hydrolysis acidification reactor, the first submerged biofilm reactor and the second submerged biofilm reactor were 0.5~1.0 mg/L, 3.0~3.3 mg/L and 1.8~2.3 mg/L, respectively, the system performance was the optimal and COD_{cr} and TN removal efficiency was up to 95.85% and 61.04%.

Key words: nylon₆ production wastewater; circumfluence ratio; DO; removal of carbon and nitrogen

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In the present study, a combined system consisting of hydrolysis acidification and submerged biofilm system was used to treat the wastewater from nylon₆ production industry. The main contaminations of nylon₆ production wastewater are COD_{cr} and caprolactam. Under the aerobic conditions, caprolactam degrades into CO₂, H₂O and NH₃, which will result in high concentration TN in the system. Effluents containing nitrogen can cause serious environmental problems, such as an increase in biological oxygen demand and eutrophication of rivers and lakes^[1-4].

The main objective was to evaluate the performance of the combined system for biological removal of nitrogen and carbon from wastewater, to investigate the influence of the important operating parameters that affect the performance of the combined system.

1 Materials and methods

1.1 Experimental set up

A schematic diagram of the experimental set up was depicted in Fig. 1. The system consisted of three reactors in series. The first reactor was the hydrolysis acidification reactor which was anoxic. The second and the third reactors were aerobic submerged biofilm reactors. All the experiments were carried out at ambient temperature 20~22 °C.

2 Results and discussion

2.1 COD and total nitrogen removal

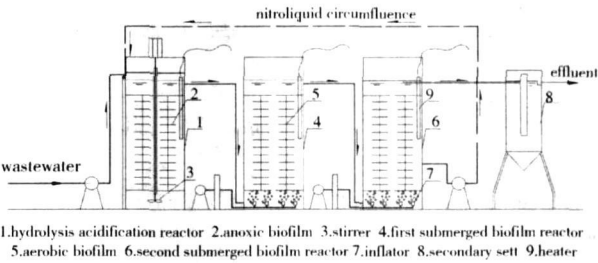


Fig. 1 Schematic diagram of the combined system

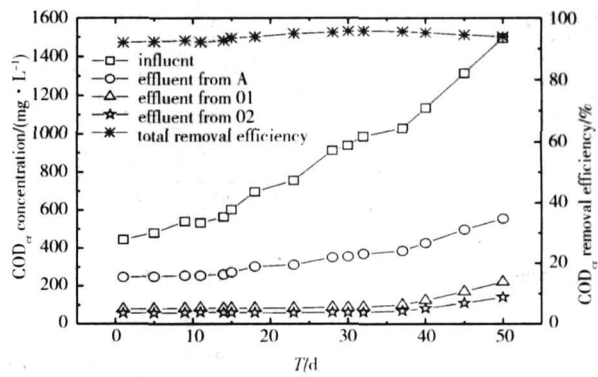


Fig. 2 COD_{cr} removal in the combined system

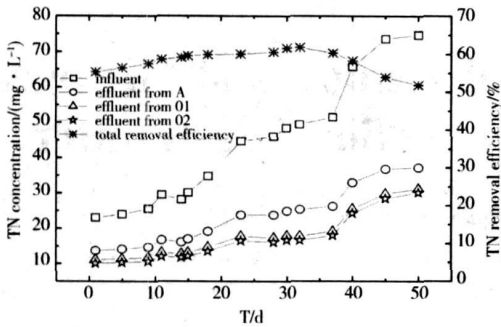


Fig 3 TN removal in the combined system

2.2 Influence of Circumfluence ratio

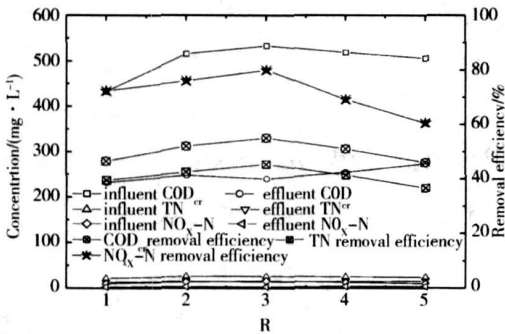


Fig 4 The effect of circumfluence ratios

2.3 Influence of HRT

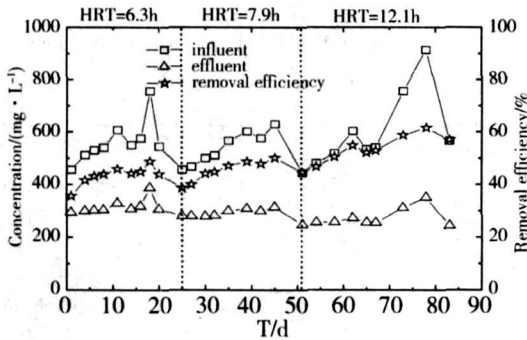


Fig 5 The varied trend of CODcr along with HRT

3 Conclusions

The following conclusions were obtained

- (1) Operating with circumfluence ratio being 3, HRT being 12.1 h, DO concentration in three reactors being 0.5~1.0 mg/L, 3.0~3.3 mg/L and 1.8~2.3 mg/L, respectively, the performance of the combined system is optimal, and COD_{cr} and TN removal efficiency was 95.85% and 61.04%.
- (2) The circumfluence ratio was the important affecting factor.
- (3) DO concentrations in two submerged biofilm reactors remarkably affected the performance of the combined system.

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组合式生物脱氮除碳法处理尼龙 6 废水

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摘 要: 用包含水解酸化、硝化和反硝化三个反应器的组合式生物脱氮除碳系统处理尼龙 6 废水, 着重分析了该系统的回流比, 溶解氧。结果显示系统的最佳工艺参数为: 回流比为 3, 反应器的溶解氧分别为 0.5~1.0 mg/L、3.0~3.3 mg/L、1.8~2.3 mg/L, 同时 COD_{cr} 和 TN 的去除率分别为 95.85%、61.04%。

关键词: 尼龙 6 废水; 回流比; 溶解氧; 脱氮除碳

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