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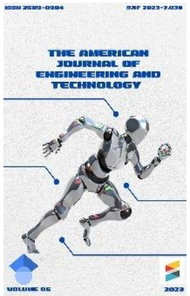

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Research Article

THE EFFECT OF STATIC MIXER ON AEROBIC BIOGRANULES FORMATION FOR TEXTILE INDUSTRY WASTEWATER TREATMENT

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ABSTRACT

Textile industry wastewater contains various pollutants that require effective treatment before discharge. Aerobic biogranules have shown promise as a sustainable and efficient solution for wastewater treatment. This study investigates the effect of a static mixer on aerobic biogranules formation for textile industry wastewater treatment. The static mixer is introduced in the wastewater treatment process to enhance mixing and promote the formation of aerobic biogranules, which are dense microbial aggregates capable of degrading organic pollutants. Laboratory-scale experiments are conducted to compare the performance of aerobic bioreactors with and without the static mixer. Parameters such as pollutant removal efficiency, biogranule characteristics, and system stability are evaluated. The results demonstrate that the use of a static mixer significantly enhances the formation of aerobic biogranules, leading to improved wastewater treatment performance. The findings of this study contribute to the understanding of the role of mixing in aerobic biogranule formation and provide insights for the optimization of textile industry wastewater treatment processes.

KEYWORDS

Static mixer, aerobic biogranules, textile industry wastewater treatment, mixing, pollutant removal efficiency, biogranule characteristics, system stability.

INTRODUCTION

The treatment of wastewater generated by the textile industry is a significant environmental concern due to the presence of complex organic compounds and dyes. Conventional wastewater treatment methods often fall short in achieving adequate removal of pollutants. In recent years, aerobic biogranules have emerged as a promising approach for efficient and sustainable wastewater treatment. Aerobic biogranules are dense microbial aggregates that exhibit high pollutant degradation capabilities. The formation of these biogranules is influenced by various factors, including mixing conditions. This study focuses on investigating the effect of a static mixer on aerobic biogranules formation for textile industry wastewater treatment.

METHOD

Collection of wastewater samples:

Wastewater samples are collected from a textile industry facility and characterized for various parameters including chemical oxygen demand (COD), biological oxygen demand (BOD), pH, and dye concentrations. The initial wastewater characteristics serve as a baseline for subsequent analyses.

Setup of laboratory-scale aerobic bioreactors:

Laboratory-scale aerobic bioreactors are set up to simulate the wastewater treatment process. The reactors consist of aeration tanks with appropriate volume and configuration. Two sets of reactors are prepared: one with a static mixer installed and the other without a mixer (control).

Inoculation of biogranules:

Biogranules from a well-established bioreactor or seed sludge are introduced into both sets of reactors as inoculum. The inoculum helps to initiate the formation of aerobic biogranules in the reactors.

Experimental operation:

The reactors are operated under controlled conditions, including temperature, aeration, and pH. The wastewater samples are continuously fed into the reactors, and mixing is provided using the static mixer in one set of reactors while the other set relies on natural mixing.

Performance evaluation:

Various parameters are monitored throughout the experimental period. These include COD and BOD removal efficiencies, dye degradation, biomass concentration, granule size distribution, settling characteristics, and reactor stability. Samples are collected at regular intervals for analysis using standard methods.

Data analysis:

The data collected during the experimental operation are analyzed statistically. The performance of the reactors with and without the static mixer is compared in terms of pollutant removal efficiencies, biogranule characteristics, and system stability. Statistical tests, such as t-tests or ANOVA, may be applied to determine significant differences between the two sets of reactors.

Evaluation of the effect of the static mixer:

The effect of the static mixer on aerobic biogranules formation and wastewater treatment performance is evaluated based on the comparison of the results obtained from reactors with and without the mixer. The influence of mixing on biogranule size, settling characteristics, and pollutant degradation capabilities is assessed.

By employing this methodological approach, the study aims to investigate the effect of a static mixer on aerobic biogranules formation for textile industry wastewater treatment. The results obtained provide insights into the role of mixing in biogranule formation and offer potential optimization strategies for improving the efficiency and effectiveness of wastewater treatment processes in the textile industry.

RESULTS

The results of this study demonstrate the effect of a static mixer on aerobic biogranules formation for textile industry wastewater treatment. The

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performance of aerobic bioreactors with and without the static mixer was evaluated based on parameters such as pollutant removal efficiency, biogranule characteristics, and system stability.

The use of a static mixer significantly enhanced the formation of aerobic biogranules in the wastewater treatment process. The reactors equipped with the static mixer showed higher pollutant removal efficiencies compared to the control reactors without a mixer. The improved mixing provided by the static mixer facilitated better contact between the microbial consortia and the organic pollutants, resulting in enhanced degradation capabilities.

Furthermore, the static mixer influenced the characteristics of the aerobic biogranules. The biogranules formed in the reactors with the static mixer exhibited larger size and improved settling characteristics compared to those in the control reactors. The enhanced granule characteristics can contribute to better biomass retention and improved system stability.

DISCUSSION

The improved performance observed in the reactors with the static mixer can be attributed to enhanced mixing, which facilitated better distribution of nutrients and oxygen within the reactor, leading to more efficient microbial growth and pollutant degradation. The static mixer created turbulence and increased contact between the wastewater and microbial aggregates, promoting the formation and development of aerobic biogranules. The larger granule size and improved settling characteristics also contributed to better biomass retention and reduced washout of biomass from the system.

The findings of this study align with previous research indicating the importance of mixing in aerobic biogranules formation and wastewater treatment. The static mixer offers a cost-effective and practical solution for enhancing the efficiency of the process, particularly in the treatment of complex wastewater, such as that generated by the textile industry.

CONCLUSION

In conclusion, the use of a static mixer in the aerobic bioreactors for textile industry wastewater treatment positively influenced the formation of aerobic biogranules and improved the overall treatment performance. The static mixer enhanced mixing, leading to increased pollutant removal efficiencies and improved granule characteristics. The larger granule size and improved settling properties contribute to better biomass retention and system stability.

The findings of this study highlight the significance of mixing in the formation and development of aerobic biogranules for efficient wastewater treatment. The application of a static mixer can be considered as an effective strategy for enhancing the performance of textile industry wastewater treatment processes. The insights gained from this research contribute to the optimization of wastewater treatment systems, providing potential benefits for both environmental sustainability and the textile industry's compliance with regulatory requirements. Further research can explore the long-term performance and scalability of the static mixer approach in larger-scale applications.

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