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RESEARCH NOTES

FISH技术监测硫酸盐还原反应器中碱度降低对功能微生物群落的影响

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摘要 Alkalinity is one of the most important parameters that influence microbial metabolism and activity during sulfate-laden wastewater biological treatment. To comprehensively understand the structure and dynamics of functional microbial community under alkalinity changes in sulfate-reducing continuous stirred tank reactor (CSTR), fluorescent in situ hybridization (FISH) technique was selected for qualitative and semi-quantitative analysis of functional microbial compositions in activated sludge. During 93d of bioreactor operation, the influent alkalinity was adjusted by adding sodium bicarbonate from 4000mg•L－1 down to 3000mg•L－1, then to 1500mg•L－1, whereas other parameters, such as the loading rates of chemical oxygen demand (COD) and sulfate ( ), hy-draulic retention time (HRT), and pH value, were continuously maintained at 24g•L－1•d－1 and 4.8g•L－1•d－1, 10h, and about 6.7, respectively. Sludge samples were collected during different alkalinity levels, and total Bacteria, the sulfate-reducing bacteria (SRB), and four SRB genera were demonstrated with 16S ribosomal RNA-targeted oli-gonucleotide probes. The results indicated that bioreactor started-up successfully in 30d. The two instances of drop in alkalinity resulted in the fluctuation of sulfate removal rate. The diversity of SRB community showed significant shift, and the alteration of microbial community directly resulted in the corresponding statuses of bioreactor. The dominant genera during the bioreactor start-up and alkalinity drops were Desulfovibrio, Desulfobacter, Desulfovi-brio, Desulfobacter, and Desulfovibrio, respectively. In addition, the acetotrophic SRB suffered more from the re-duction of alkalinity than the non-acetotrophic SRB. This strategy can present the functional microbial community structure during start-up and alkalinity drop stages, and provides a powerful theoretical guideline for optimization and adjustment of bioreactor, as well.

关键词 alkalinity sulfate-reducing bacterium fluorescent in situ hybridization

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Impacts of alkalinity drops on shifting of functional sulfate-reducers in a sulfate-reducing bioreactor characterized by FISH

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Abstract Alkalinity is one of the most important parameters that influence microbial metabolism and activity during sulfate-laden wastewater biological treatment. To comprehensively understand the structure and dynamics of functional microbial community under alkalinity changes in sulfate-reducing continuous stirred tank reactor (CSTR), fluorescent in situ hybridization (FISH) technique was selected for qualitative and semi-quantitative analysis of functional microbial compositions in activated sludge. During 93d of bioreactor operation, the influent alkalinity was adjusted by adding sodium bicarbonate from 4000mg•L－1 down to 3000mg•L－1, then to 1500mg•L－1, whereas other parameters, such as the loading rates of chemical oxygen demand (COD) and sulfate ( ), hy-draulic retention time (HRT), and pH value, were continuously maintained at 24g•L－1•d－1 and 4.8g•L－1•d－1, 10h, and about 6.7, respectively. Sludge samples were collected during different alkalinity levels, and total Bacteria, the sulfate-reducing bacteria (SRB), and four SRB genera were demonstrated with 16S ribosomal RNA-targeted oli-gonucleotide probes. The results indicated that bioreactor started-up successfully in 30d. The two instances of drop in alkalinity resulted in the fluctuation of sulfate removal rate. The diversity of SRB community showed significant shift, and the alteration of microbial community directly resulted in the corresponding statuses of bioreactor. The dominant genera during the bioreactor start-up and alkalinity drops were Desulfovibrio, Desulfobacter, Desulfovi-brio, Desulfobacter, and Desulfovibrio, respectively. In addition, the acetotrophic SRB suffered more from the re-duction of alkalinity than the non-acetotrophic SRB. This strategy can present the functional microbial community structure during start-up and alkalinity drop stages, and provides a powerful theoretical guideline for optimization and adjustment of bioreactor, as well.

Key words alkalinity; sulfate-reducing bacterium; fluorescent in situ hybridization

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