

能源和环境工程

pH和碱度对同步厌氧生物脱氮除硫工艺性能的影响

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摘要

采用UASB反应器研究了pH和碱度对同步厌氧生物脱氮除硫工艺性能的影响。控制进水pH在7.5~8.0之间,反应器的最大容积硫化物和硝酸盐去除速率分别为 $2.96 \text{ kg} \cdot (\text{m}^3 \cdot \text{d})^{-1}$ 和 $0.47 \text{ kg} \cdot (\text{m}^3 \cdot \text{d})^{-1}$ (分别以硫元素、氮元素计),反应过程产碱及残留硫化物,均会导致反应液pH值过高(9.11 ± 0.38),引发高负荷时工艺失稳。控制反应液pH在 7.0 ± 0.1 范围,容积硫化物和硝酸盐去除速率分别可达 $4.78 \text{ kg} \cdot (\text{m}^3 \cdot \text{d})^{-1}$ 和 $0.99 \text{ kg} \cdot (\text{m}^3 \cdot \text{d})^{-1}$,容积效能高于控制进水pH时的相应值。要维持反应所需的中性条件,碱度宜控制在 $(454.1 \pm 40.5) \text{ mg} \cdot \text{L}^{-1}$ (以 CaCO_3 计)。反应过程中的碱度变化(增量)可以指示反应器内主导反应的类型及其反应进度。单质硫型生物脱氮除硫反应(硫氮比为5:2)和硫酸盐型生物脱氮除硫反应(硫氮比为5:8)的硫化物去除量与碱度减少量之比分别为2.27和2.00,混合型生物脱氮除硫反应(硫氮比为5:5)的硫化物去除量与碱度减少量之比为5.00。

关键词

[厌氧脱氮除硫](#) [pH](#) [碱度](#)

分类号

Influence of pH and alkalinity on process performance of simultaneous anaerobic sulfide and nitrate removal

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Abstract

The influence of pH and alkalinity on the process performance of simultaneous anaerobic sulfide and nitrate removal was studied in Upflow Anaerobic Sludge Blanket (UASB) reactor. When the influent pH was controlled between 7.5 and 8.0, the maximum sulfide and nitrate removal loading rate were $2.96 \text{ kg} \cdot (\text{m}^3 \cdot \text{d})^{-1}$ and $0.47 \text{ kg} \cdot (\text{m}^3 \cdot \text{d})^{-1}$, respectively. The basifying reaction and remnant sulfide led to increasing pH values that were finally beyond the bacteria toleration and caused process instability at high loading rates. When the reaction pH was controlled between 6.9 and 7.1, the maximum sulfide and nitrate removal loading rates were $4.78 \text{ kg} \cdot (\text{m}^3 \cdot \text{d})^{-1}$ and $0.99 \text{ kg} \cdot (\text{m}^3 \cdot \text{d})^{-1}$, respectively. The alkalinity should be adjusted at $(454.1 \pm 40.5) \text{ mg} \cdot \text{L}^{-1}$ to keep a neutral condition. The alkalinity change in the process can indicate the style and extent of the dominant reaction. When S/N=5:2 (with sulfur as main product), S/N=5:8 (with sulfate as main product) and S/N=5:5 (with the mixture of sulfur and sulfate as main product), the ratios of removed sulfide to decreased alkalinity were 2.27, 2.00 and 5.00.

Key words

[anaerobic sulfide and nitrate removal](#) [pH](#) [alkalinity](#)

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