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## 氢自养反硝化系统中亚硝酸盐的累积特性

摘要点击 5 全文点击 2 投稿时间: 2007-9-29 最后修改时间: 2007-12-1

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中文关键词 [亚硝酸盐累积](#) [反硝化系数](#) [氢自养反硝化](#) [饮用水](#)

英文关键词 [nitrite accumulation](#) [denitrification coefficient](#) [hydrogenotrophic denitrification](#) [drinking water](#)

作者

单位

E-mail

[陆彩霞](#)

[天津大学环境科学与工程学院, 天津300072](#)

[顾平](#)

[天津大学环境科学与工程学院, 天津300072](#)

### 中文摘要

建立了序批式反应器氢自养反硝化系统中亚硝酸盐累积的数学模型, 定义了反硝化系数 $\alpha$ 来描述亚硝酸盐的累积状况, 研究了序批式反应器内加入亚硝酸盐前后硝酸盐和亚硝酸盐还原速率以及亚硝酸盐累积浓度的变化情况. 结果表明, 第1阶段中硝酸盐的还原速率为 $6.52 \text{ mg}/(\text{L}\cdot\text{h})$ , 亚硝酸盐的还原速率为 $4.40 \text{ mg}/(\text{L}\cdot\text{h})$ , 亚硝酸盐累积明显, 加入亚硝酸盐后亚硝酸盐的还原速率上升到 $4.89 \text{ mg}/(\text{L}\cdot\text{h})$ ; 第2阶段中硝酸盐的还原速率下降到 $3.94 \text{ mg}/(\text{L}\cdot\text{h})$ , 此时几乎无亚硝酸盐累积. 亚硝酸盐的加入, 改变了硝酸盐和亚硝酸盐的还原速率, 从而最终影响了亚硝酸盐的累积浓度. 亚硝酸盐的累积过程与根据模型计算得出的理论值吻合较好; 反硝化系数 $\alpha$ 能够准确反映亚硝酸盐的累积状况:  $\alpha < 1$ 时, 亚硝酸盐累积明显, 最大累积浓度达到 $11.06 \text{ mg}/\text{L}$ ,  $\alpha > 1$ 时, 亚硝酸盐累积浓度很低,  $< 0.30 \text{ mg}/\text{L}$ .

### 英文摘要

A mathematic model for nitrite accumulation in a hydrogenotrophic denitrification system running in a sequencing batch mode was developed and denitrification coefficient  $\alpha$  was defined to describe the process of nitrite accumulation. The reduction rates of nitrate and nitrite and the nitrite accumulation before/after the nitrite addition were investigated using a sequencing batch reactor. The result showed that in Run 1 the reduction rates of nitrate and nitrite were  $6.52 \text{ mg}/(\text{L}\cdot\text{h})$  and  $4.40 \text{ mg}/(\text{L}\cdot\text{h})$  respectively, accompanied with the remarkable nitrite accumulation. The reduction rate of nitrite increased to  $4.89 \text{ mg}/(\text{L}\cdot\text{h})$  after nitrite addition. In Run 2, the reduction rate of nitrate decreased to  $3.94 \text{ mg}/(\text{L}\cdot\text{h})$  and almost no nitrite accumulation was observed. The addition of nitrite changed both the reduction rates of nitrate and nitrite, and finally showed an effect on the accumulated concentration of nitrite. The process of nitrite accumulation was identical with the theoretical one calculated according to the model. The nitrite accumulation could be exactly reflected by the defined denitrification coefficient  $\alpha$ . When  $\alpha$  was less than 1, nitrite accumulation was observed obviously with the maximum concentration  $11.06 \text{ mg}/\text{L}$ . While when  $\alpha$  was more than 1, accumulated nitrite concentration was lower than  $0.30 \text{ mg}/\text{L}$ .

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主办单位: 中国科学院生态环境研究中心 单位地址: 北京市海淀区双清路18号

电话: 010-62941102, 62849343 传真: 010-62849343 邮编: 100085 E-mail: [hjks@cees.ac.cn](mailto:hjks@cees.ac.cn)

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