

实时荧光定量PCR对A²/O短程硝化系统内氨氧化菌的定量分析

Real-time PCR quantification of ammonia oxidizing bacteria in short-cut A²/O process treating domestic wastewater

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作者	单位
李磊	北京工业大学环境与能源工程学院, 北京 100124
张立东	北京工业大学建筑勘查设计院, 北京 100124
刘晶茹	大连海洋大学土木工程学院, 大连 116023
曾薇	北京工业大学环境与能源工程学院, 北京 100124
杨莹莹	北京工业大学环境与能源工程学院, 北京 100124
王向东	北京工业大学环境与能源工程学院, 北京 100124

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中文摘要:

通过控制好氧区低DO浓度以及缩短好氧实际水力停留时间(actual hydraulic retention time, AHRT), 在处理低C/N比实际生活污水的A²/O工艺中, 成功启动并维持了短程硝化反硝化; 系统亚硝酸盐积累率稳定维持在90%左右, 氨氮去除率在95%以上。通过提取富集氨氧化菌(ammonia oxidizing bacteria, AOB)的基因组DNA, 经两次常规PCR扩增和琼脂糖凝胶电泳, 以纯化回收的DNA扩增片段作为实时荧光定量PCR检测AOB数量的DNA标准品, 建立了检测AOB数量的实时荧光定量PCR标准曲线。利用实时荧光定量PCR技术比较了A²/O系统在不同运行条件及亚硝酸盐积累率情况下AOB菌群数量。结果表明, 随着系统亚硝酸盐积累率的上升, 系统内AOB菌群数量也大幅上升。全程硝化和短程硝化时, 系统内的AOB菌群数量分别为 5.28×10^9 cells/g MLVSS和 3.95×10^{10} cells/g MLVSS。此外, 亚硝酸盐积累率的下降相对于AOB菌群数量的下降有一定的滞后性。

英文摘要:

Short-cut nitrification and denitrification was started up and maintained in a lab-scale A²/O process treating low C/N ratio domestic wastewater by controlling DO concentration in low level and decreasing the aerobic actual hydraulic retention time (AHRT). The average nitrite accumulation rate reached about 90% and above 95% of ammonia nitrogen (NH₄⁺-N) could be removed. The genome DNA of the enriched ammonia oxidizing bacteria (AOB) culture was extracted and amplified, and then electrophoresed on agarose gel twice. The DNA fragments in reamplified agarose gel bands were recovered and purified, and then used as standard molecule. A standard curve of real-time fluorescent PCR was set up for AOB quantification. The numbers of the AOB in sludge samples under different operational conditions and nitrite accumulation rates were monitored and compared by using real-time quantitative PCR. The results showed that the numbers of AOB significantly increased with increasing of nitrite accumulation rates. The numbers of AOB in the complete nitrification activated sludge and short-cut nitrification activated sludge were 5.28×10^9 cells/g MLVSS and 3.95×10^{10} cells/g MLVSS, respectively. Moreover, the decrease of the nitrite accumulation rates lagged behind the decline of AOB numbers.

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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 邮编：100085

编辑部服务热线：010-62941074 传真：010-62941074 邮箱：cjee@rcees.ac.cn

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