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CHARACTERIZATION OF NITRIFICATION PERFORMANCE AND MICROBIAL COMMUNITY IN A MBBR AND INTEGRATED GBBR-MBBR TREATING HEAVILY POLLUTED RIVER WATER

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Abstract

A one-stage aerobic moving bed biofilm reactor (MBBR) (Reactor A) and a combined reactor (Reactor B) involving an anoxic gravel-bed biofilm reactor (GBBR) and an aerobic MBBR were applied to the treatment of heavily polluted river water. Reactor performance was investigated throughout the experiment for almost 200 days and molecular techniques including PCR-DGGE, FISH/CLSM and FISH/FCM were used to reveal the evolutions of bacteria community, abundance of nitrifying bacteria and their spatial distribution in biofilms for the comparative study of the two reactors. Results show that Reactor B performed better than Reactor A in pollutants removal with COD, ammonia and TN removals enhanced by 6-16%, 32-59%, and 9-31%, respectively. In addition, Reactor B was more stable towards the increasing of organic and ammonia loadings. The aerobic biofilms in Reactor B were thinner and occupied by large nitrifying populations (16-41% of the total bacteria) than the corresponding part in Reactor A (9-22% of the total bacteria). On the whole, the integrated GBBR-MBBR was more efficient and lower-cost compared to the one-stage MBBR and therefore more suitable for the treatment of the river water.

Key words: ammonia oxidation, biofilm, microbial community, moving bed biofilm reactor, nitrifying bacteria

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