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Study on the Rapid Start-up and Functional Microorganisms of the Coupled Process of Short-range Nitrification and Anammox in Landfill Leachate Treatment

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Abstract : The excessive discharge of nitrogen in sewage greatly intensifies the eutrophication of water bodies and poses a threat to water quality. Nitrogen pollution control has become a global concern. Currently, the problem of water pollution in China is still not optimistic. As a typical high ammonia nitrogen organic wastewater, landfill leachate is more difficult to treat than domestic sewage because of its complex water quality, high toxicity, and high concentration.Many studies have shown that the autotrophic anammox bacteria in nature can combine nitrous and ammonia nitrogen without carbon source through functional genes to achieve total nitrogen removal, which is very suitable for the removal of nitrogen from leachate. In addition, the process also saves a lot of aeration energy consumption than the traditional nitrogen removal process. Therefore, anammox plays an important role in nitrogen conversion and energy saving. The process composed of short-range nitrification and denitrification coupled an ammo ensures the removal of total nitrogen and improves the removal efficiency, meeting the needs of the society for an ecologically friendly and cost-effective nutrient removal treatment technology. Continuous flow process for treating late leachate [an up-flow anaerobic sludge blanket reactor (UASB), anoxic/oxic (A/O)–anaerobic ammonia oxidation reactor (ANAOR or anammox reactor)] has been developed to achieve autotrophic deep nitrogen removal. In this process, the optimal process parameters such as hydraulic retention time and nitrification flow rate have been obtained, and have been applied to the rapid start-up and stable operation of the process system and high removal efficiency. Besides, finding the characteristics of microbial community during the start-up of anammox process system and analyzing its microbial ecological mechanism provide a basis for the enrichment of anammox microbial community under high environmental stress. One research developed partial nitrification-Anammox (PN/A) using an internal circulation (IC) system and a biological aerated filter (BAF) biofilm reactor (IBBR), where the amount of water treated is closer to that of landfill leachate. However, new high-throughput sequencing technology is still required to be utilized to analyze the changes of microbial diversity of this system, related functional genera and functional genes under optimal conditions, providing theoretical and further practical basis for the engineering application of novel anammox system in biogas slurry treatment and resource utilization.

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