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Effects of filler height and mechanical ventilation on the treatment effect and bacterial community diversity of CRI

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ABSTRACT

This study was aimed at exploring the effect of filler height and mechanical ventilation on the treatment effect and bacterial community diversity of CRI (artificial rapid infiltration system), high-throughput sequencing technology was used to study the bacterial community diversity in three groups of CRI. The results showed that the average removal rates of chemical oxygen demand (COD), ammonia nitrogen, total nitrogen, total phosphorus and the concentration of nitrate nitrogen in the effluent of CRI were added by increasing the filler height. Adding mechanical ventilation could improve the removal rate of COD and total phosphorus and the concentration of effluent nitrate nitrogen, but reduced the removal rate of total nitrogen. The results of Chao1 index, observed species index, Simpson index and Shannon index all showed that increasing the height of filler increased the richness and diversity of bacterial communities in CRI, while increasing mechanical ventilation increased the richness and diversity of bacterial communities in the upper part of CRI, but decreased the richness and diversity of bacterial communities in the middle and lower parts of CRI. Increasing the filler height not only prolonged the contact time of wastewater with filler and its surface microorganisms, but also increased the average relative abundance of Nitrospirae at 0.8 m of CRI by 3.11%. Therefore, increasing the filler height is conducive to the removal of organic matter, phosphorus and nitrification in CRI. Increasing mechanical ventilation increased the average relative abundance of Proteobacteria by 4.81% and 13.86% at 0.3 and 0.8 m, and decreased the average relative abundance of Bacteroidetes by 2.34% and 4.59% at 0.8 and 1.3 m, respectively. Therefore, increasing mechanical ventilation is conducive to the removal of organic matter and phosphorus in CRI, but not conducive to denitrification.

Keywords: Filler height; Mechanical ventilation; Constructed rapid infiltration system; Nitrogen and phosphorus conservation; Bacterial diversity

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