Nitrogen removal performance and functional genes distribution patterns in solid-phase denitrification sub-surface constructed wetland with micro aeration

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Nitrogen removal performance and functional genes distribution patterns in solid-phase denitrification sub-surface constructed wetland with micro aeration

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Abstract

An up-flow vertical flow constructed wetland (AC-VFCW) filled with ceramsite and 5% external carbon source poly(3-hydroxybutyrate-hydroxyvalerate) (PHBV) as substrate was set for nitrogen removal with micro aeration. Simultaneous nitrification and denitrification process was observed with 90.4% NH_4^+-N and 92.1% TN removal efficiencies. Nitrification and denitrification genes were both preferentially enriched on the surface of PHBV. Nitrogen transformation along the flow direction showed that NH_4^+-N was oxidized to NO_3^--N at the lowermost 10cm of the substrate and NO_3^--N gradually degraded over the depth. *AmoA* gene was more enriched at -10 and -50cm layers. *NirS* gene was the dominant functional gene at the bottom layer with the abundance of 2.05×10^7 copies g^{-1} substrate while *nosZ* gene was predominantly abundant with 7.51×10^6 and 2.64×10^6 copies g^{-1} substrate at the middle and top layer, respectively, indicating that functional division of dominant nitrogen functional genes forms along the flow direction in AC-VFCW.

Keywords: Vertical flow constructed wetland; Solid-phase denitrification; Aeration; Functional genes; Nitrogen removal