Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2017.21251

85 (2017) 358–364
August

Effects of plant species on CH_4 emission from integrated vertical subsurface flow constructed wetlands

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Received 10 November 2016; Accepted 26 July 2017

ABSTRACT

Methane (CH_4) emission from constructed wetlands (CWs) has increased the amount of greenhouse gases (GHG) and raised environmental concerns. The plant species could significantly affect the CH_4 emission in integrated vertical subsurface flow constructed wetlands (IVSSF CWs). This study evaluated the removal efficiency of water pollutants and determined the influence of plant species on CH_4 fluxes in IVSSF CWs planted with *Cyperus alternifolius*, *Canna indica*, *Acorus calamus*, and *Scirpus tabernaemontani*. Result indicated that the pollutant removal efficiency in IVSSF CWs planted with *C. alternifolius* was apparently higher than that in the wetlands planted with the three other plants. The mean removal efficiencies in CWs planted with *C. alternifolius* were 84.46% for chemical oxygen demand (COD), 85.80% for NH_4-N, 82.94% for total nitrogen, and 94.87% for total phosphorous. The average CH_4 fluxes were 5.45 mg m^{-2} h^{-1} (*A. calamus*), 2.49 mg m^{-2} h^{-1} (*S. tabernaemontani*), 9.26 mg m^{-2} h^{-1} (*C. indica*), and 3.25 mg m^{-2} h^{-1} (*C. alternifolius*). The CH_4 fluxes in IVSSF CWs planted with *C. alternifolius*, *C. indica*, and *S. tabernaemontani* were significantly correlated with temperature ($P < 0.05$). Moreover, the CH_4 fluxes in IVSSF CWs planted with *C. indica* and *A. calamus* significantly differed between up-flow and down-flow chambers ($P < 0.05$). The relationship between CH_4 flux and removal loading of COD was also analyzed. *S. tabernaemontani* and *A. calamus* were found to be the optimal plants for COD removal in IVSSF CWs in summer and winter, respectively. The results can be helpful for plants optimization in CWs and provide the data support for the control of GHG emission.

Keywords: Constructed wetland; Water purification; Greenhouse gas flux; Plants optimization

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