



A comparative estimate of life cycle greenhouse gas emissions from two types of constructed wetlands in Tianjin, China

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ABSTRACT

Constructed wetlands (CWs) are widely used for wastewater treatment, but may also be sources of greenhouse gas (GHG). This study focuses on comparing the GHG emissions from a vertical flow constructed wetland (VFCW) and a horizontal flow constructed wetland (HFCW) in the city of Tianjin, China. Two methods are used in this paper to estimate the indirect and direct GHG emissions. It is found that the VFCW emits 0.09, 1.34, and 3.31 kg equivalent CO₂ (CO₂ Eq.) to remove 1.00 m³ wastewater, 1.00 kg COD, and 1.00 kg BOD in the studied life cycle, respectively, in contrast to 0.18, 2.10, and 5.42 kg CO₂ Eq. for the HFCW. The results indicate that the adoption of VFCW is a more effective option with respect to GHG emissions when treating the same amount of pollutants. In addition, the operation phase which includes GHG emissions from water treatment process and energy consumption for pump dominates the GHG emissions. For different kinds of GHG from CWs, CO₂ dominates the influence on climate change. The CH₄ and N₂O emissions should also deserve more attention due to their greater global warming potential. This paper further suggests that GHG emissions can be mitigated in the design, construction, and operation stages through some feasible measures. It would reduce GHG emissions in CWs by adopting hybrid CW system (e.g. HF–VF or VF–HF) or choosing suitable plant species which can mitigate GHG emissions. In addition, aeration could contribute to the control of GHG emissions from CWs.

Keywords: Constructed wetlands; GHG emission; Wastewater treatment; Vertical flow; Horizontal flow

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