

Effect of design and dosing regime on the treatment performance of vertical flow constructed wetlands

Master's thesis project in Ecology and the Environment 2011

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Abstract

Vertical flow constructed wetlands (VF CWs) are becoming more popular options for onsite wastewater treatment due to their high oxygen transfer capacity and high nitrification rates. However, there are still some question marks regarding (1) how the treatment performance of VF CWs is affected by design and operational parameters, and (2) the treatment processes happening inside the wetland bed as the wastewater percolates through. In this study, we investigated the effects of filter media size (coarse sand or fine gravel), dosing regime (hourly with 2 mm or bi-hourly with 4 mm) and plant presence (with or without *Phragmites australis*) on the overall treatment performance and depth profiles of pollutant removal in six pilot-scale VF CWs treating primary treated domestic wastewater. Grab samples of wastewater were collected every 2-3 weeks during 5 months and analyzed for organic matter, suspended solids, nitrogen and *E. coli*. We found that sand performed better than gravel for removal of all pollutants except total nitrogen, although for long term operation gravel may be less susceptible to clogging. The overall treatment performance was not affected by different dosing regimes, but the depth profiles showed that smaller and more frequent doses led to more pollutant removal in the upper part of the wetland. The presence of plants was moderately important for the removal of ammonium, but had no effect on other pollutants.