REMOVAL OF NITROGEN AND PHOSPHORUS BY WETLAND MESOCOSMS SUBJECTED TO DIFFERENT HYDROPERIODS

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ABSTRACT

The effect of hydroperiod upon nutrient removal efficiency was investigated in replicate wetland mesocosms (each 2 m^2). Alternate draining and flooding of sediments increased the nutrient removal efficiency of constructed wastewater wetland mesocosms compared to continuously flooded systems. Average PO_4^{3-} removal efficiency was 20-30% higher in wetland mesocosms that drained twice daily compared to continuously flooded wetlands. Inorganic N removal efficiency was less affected than phosphate removal by hydroperiod treatments. At the higher NH_4^+ loading rate (6.1 $gN/m^3/d$), inorganic N removal efficiency was consistently 5-20% higher in pulsed-discharge wetland mesocosms compared to continously flooded systems. Pulsed-discharge hydrology, however, had no effect on inorganic N removal efficiency at the lower NH_4^+ loading rate (3.0 $gN/m^3/d$). The hydroperiod treatment with sediments draining twice per day exhibited average inorganic N removal efficiencies of 96% (lower N loading rate) and 87% (higher N loading rate) and average phosphate removal efficiencies of 81% (lower P loading rate) and 90% (higher P loading rate).

Mass balance data from the continuously flooded mesocosms reveal that the aquatic macrophyte, *Scirpus californicus*, was the most important nutrient sink, assimilating 50% of the NH_4^+ and

PO_4^{3-} supply. Results from the addition of a nitrification-inhibitor (N-Serve) indicate that 34% of the NH_4^+ supply was transformed to NO_3^- by nitrifying bacteria.

These results suggest that hydroperiod can be manipulated to improve nutrient removal in wastewater wetlands and wastewater wetlands can be designed with high plant nutrient uptake rates if the ratio of edge to surface area is maximized.