Title: EMISSIONS OF GREENHOUSE GASES CARBON DIOXIDE AND METHANE FROM DUCKWEED SYSTEMS FOR STORMWATER TREATMENT

This study determined the greenhouse gas emission from lab-scale duckweed treatment systems that were used for stormwater treatment. By using the static chamber technique, the fluxes of CO$_2$ emission from the duplicate duckweed systems were 1472 ± 721 and 626 ± 234 mg m$^{-2}$ d$^{-1}$, respectively. After the complete removal of duckweeds, CO$_2$ emission from the systems decreased to 492 ± 281 and 395 ± 53 mg m$^{-2}$ d$^{-1}$, respectively. A thin-film model was successfully applied to predict the increasing CO$_2$ concentrations approaching saturation in the static chamber. In contrast, the concentrations of methane in the closed chamber fluctuated a lot with time, which were attributed to complex methane production and consumption reactions at the soil-water interface. The CH$_4$ flux from the two duckweed systems were 299 ± 74 mg m$^{-2}$ d$^{-1}$ and 180 ± 91 mg m$^{-2}$ d$^{-1}$, respectively. After the removal of duckweeds, the flux were 559 ± 215 mg m$^{-2}$ d$^{-1}$ and 328 ± 114 mg m$^{-2}$ d$^{-1}$, respectively. The higher CO$_2$ emission in the duckweed systems was linked to more biomass debris formation on the soil surface due to duckweed growth and decay. As a result of duckweed growth, the duplicated duckweed systems removed 54 ± 13 % COD, 94 ± 4 % NH$_4^+$-N, 87 ± 7 % NO$_3^-$-N, 34 ± 7 % PO$_4^{3-}$-P at the hydraulic retention time of 10 days. When the duckweeds were removed, the nutrient removal efficiencies decreased significantly: 68 ± 3 % for NH$_4^+$-N, 43 ± 7 % for NO$_3^-$-N, 10 ± 6 % for PO$_4^{3-}$-P. The COD removal efficiency without duckweeds was 47 ± 6 %, which did not change significantly.