This study was done to investigate the performance of vertical subsurface flow (VSF) wetlands with additional carbon sources in reducing the nitrogen in stormwater from livestock lots. Three experimental lab-scale VSF wetlands packed with woodchips were constructed. The wetlands were operated with number of dry days (NDD) of 2, 4, and 8, respectively, for a duration of 136 d. The average removal efficiencies of total nitrogen (TN) were 26.2, 34.1, and 50.0% at NDD as 2, 4, and 8, respectively. The average nitrogen removal rate based on woodchips volume was 3.6 g N m$^{-3}$ d$^{-1}$ for NDD of 2, 2.1 g N m$^{-3}$ d$^{-1}$ for NDD of 4, and 1.7 g N m$^{-3}$ d$^{-1}$ for NDD of 8. Nitrification and denitrification were the major mechanisms of nitrogen reduction in the studied wetlands. The contribution of other pathways to nitrogen removal was small. The removal of total Kjeldahl nitrogen (TKN) and TN was not affected by the influent pH, whereas the removal of TKN was enhanced by the increase in influent alkalinity. Nitrification was promoted by the abundant oxygen supplied during the course of recirculation, whereas denitrification might be suppressed to some degree by the oxygen.

Keywords: Stormwater; Livestock lots; Vertical subsurface flow wetlands; Woodchips; Carbon sources; Nitrogen removal