PB 102

Effects of carbon, nitrate, and moisture on denitrification in a riparian soil

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Denitrification is a significant process to remove nitrogen in riparian ecosystem. In this study, the effects of soil moisture, nitrate, and carbon on denitrification rate were investigated and an equation accounting for the effects was derived. Denitrification at 49% and 64% WFPS (water-filled pore space) occurred less than 4% of its maximum for water saturation and less than 28%, at 84% WFPS, suggesting that denitrification is active around water saturation. The rate was expressed as a power function of moisture (θ) above a threshold point (θ_d = 57%), maximized at water saturation (θ_s), and constant below the threshold point. Denitrification rates were increased at increasing nitrate and WSC (water soluble carbon) concentrations then stabilized, fitting in Michaelis-Menten type kinetics. Therefore, a relevant equation was adopted to describe the reaction controlled by WSC and nitrate, where V_{max} was 125ng N_2O-N g^{-1} hr^{-1} at 84% WFPS (320ng N_2O-N g^{-1} hr^{-1} at saturation), and K_n, K_c were determined to be 25.22 μg nitrate-N/g soil, and 97.62 μg WSC/g soil, respectively. With field data about soil moisture, nitrate, and WSC measured weekly from March to September, 1997, denitrification rate was estimated using the equation. The average was 124mg N_2O-N m^{-1} wk^{-1} and the N loss to N_2O and N_2 gas for 27 weeks was 3.34g N m^{-2}. Denitrification in this system was highly influenced by soil moisture as well as WSC, which was in lower range of 30-70 μg WSC/g soil than K_c.