Animal Wastewater Treatment Using Constructed Wetlands (Advanced Studies on Sustainable Animal Production: Interrelationships among Human, Animal and Environment, 8th International Symposium of Integrated Field Science)

3-1. Animal Wastewater Treatment Using Constructed Wetlands

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Data collected in December 2009 indicate that there are about 1 million livestock farms in Japan that must abide by the nation's effluent standards. A 2007 survey counted about 650 dairy farms. Wastewater from dairy farming is usually treated aerobically, but the aeration consumes large amounts of energy. Recently to achieve KYOTO Protocol requires the reduction of carbon dioxide emissions from wastewater treatment systems. Constructed wetlands have receives attention as energy-free and eco-friendly wastewater treatment systems. In this study, constructed wetlands were hybridized with vertical and horizontal flow systems to treat wastewater from a milking parlor. Water quality was investigated by determining the number of coliform bacteria and ammonia-oxidizing microbes present during the treatments. We were able to remove more than 90% of COD, TN, and TP from raw wastewater in June through September. However, these removal rates decreased after October, with the lowest removal observed in December. Real-time PCR analysis found 10^2 to 10^4 cells/cm^3 ammonia-oxidizing bacteria and 10^2 cells/cm^3 ammonia-oxidizing archaea. However, ANAMMOX bacteria were not detected in December. The removal rate of coliform bacteria did not differ from September to December, except on a single day. Furthermore, no significant differences in treatment efficiency among the three types of wetlands were observed. In particular, we found no difference in the removal rate of coliform bacteria among constructed wetlands, with or without plants. The most efficient removal of coliform bacteria was observed on October 22, following 3 days of sunny weather. This observation suggests that soil-drying due to the absence of influent was important for removing coliform bacteria. Regulations require that COD and TN concentrations in treated water that is to be reused for agriculture be less than 6 mg/L and 1 mg/L, respectively. In addition, reclaimed water for landscape use must contain fewer than 1000 cfu/100 ml coliform bacteria. The concentration of COD, TN, and coliform bacteria in the wetland-treated water in summer met these standards for agricultural and landscape reuse. In the future, further improvement of removal efficiency in constructed wetland treatments will allow more animal wastewater to be reused. In addition, a recycling system including the utilization of treated water must be established and promoted.