



## Modeling bacteria concentration in a rice paddy irrigated with reclaimed wastewater

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### ABSTRACT

The objectives of this study were to develop a simulation model of bacteria concentrations in a rice paddy where wastewater is reused, and to assess its applicability with the experimental field data. The data were collected from an experimental plot, the Byeongjeom experiment plot, where some variables are periodically monitored, e.g., rainfall, irrigation discharge, water quality, and coliform concentration. Three irrigation treatments were applied: groundwater (TR#1), wastewater (TR#2), and filtered wastewater with ultra-violet treatment (TR#3). The field scale model for chemicals, runoff, and erosion from agricultural management system for rice paddy fields (CREAMS-PADDY) was used as a hydrologic model in the paddy plot, and a first die-off function was applied for a model of bacteria concentration. Four years of daily hydrologic data were calculated by CREAMS-PADDY and its annual water balance was assessed in comparison of previous studies. Hydrologic result indicated that while the total water inflow of about 1,730 mm was from precipitation (64%), and the remainder from irrigation (36%), total water outflow generally balanced inflow, with about 35% of total outflow to surface drainage, 32% to infiltration, and 39% to evapotranspiration. Developed bacteria model for a rice paddy field was calibrated and validated. The model showed relatively good agreement in TR#2 between the observed and simulated data during the calibration and validation periods. The simulation result of TR#2 indicated that simulated average coliform data in 2003–2006 were  $4.3 \times 10^4$  MPN/100 ml,  $5.6 \times 10^4$  MPN/100 ml,  $3.8 \times 10^4$  MPN/100 ml, and  $5.5 \times 10^3$  MPN/100 ml, respectively. The simulated result of TR#2 was consistent with the observed data, and demonstrating the applicability of the model for the rice paddy.

*Keywords:* Bacteria modeling; CREAMS-PADDY; Reuse; Wastewater

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