Desalination and Water Treatment
www.deswater.com

41 (2012) 356–363
March

doi: 10.1080/19443994.2012.664739

Taylor & Francis
Taylor & Francis Group

Simulation of constructed wetland treatment in wastewater polishing using PREWet model

Caroline W. Maina[a], Benedict M. Mutua[a,*], Steve O. Oduor[b]

[a]*Department of Agricultural Engineering, Faculty of Engineering and Technology, Egerton University, P.O. Box 536-20115, Kenya*
Tel. +254 735968699; email: bmmutua@yahoo.com
[b]*Department of Biological Sciences, Faculty of Science, Egerton University, P.O. Box 536-20115, Kenya*

Received 25 November 2011; Accepted 29 January 2012

ABSTRACT

To minimize the negative impact of wastewater when disposed into water bodies, proper treatment before its disposal is vital. Different wastewater treatment scenarios can be tested using predictive and analytical models. A screening-level, analytical model known as the PREWet model was calibrated and validated. The model assumes steady-state conditions and one-dimensional longitudinally varying concentration. The model was calibrated on a pilot-scale wetland and used to predict treatment through a constructed wetland. Performance of the calibrated model was statistically evaluated for its predictive ability by simulating the wastewater treatment through a constructed wetland. Different constituents were modelled which include: total phosphorous (TP), total coliform (TC), biochemical oxygen demand (BOD) and total suspended solids (TSS). The model coefficients were estimated using field and laboratory studies. Sensitivity analysis indicated that detention time of wastewater in constructed wetland was the most sensitive parameter in the PREWet model. Coefficient of determination and Nash–Sutcliffe coefficient were used to compare the observed and simulated results. The Nash–Sutcliffe coefficient of model efficiency for TP, TC, BOD and TSS was 0.97, 0.96, 0.97 and 0.77, respectively. The PREWet model was found to be an effective tool in simulating wastewater treatment through constructed wetlands.

Keywords: Calibration; Coefficient of determination; Constructed wetlands; PREWet model; Sensitivity analysis; Simulation; Subsurface flow and tertiary treatment

*Corresponding author.