



AN EXPERIMENTAL THREE-STAGE HYBRID CONSTRUCTED WETLAND SYSTEM FOR REMOVAL OF ORGANICS AND NUTRIENTS FROM DOMESTIC WASTEWATER

Bilal Tunçsiper

Niğde University, Faculty of Engineering-Architecture, Department of Environmental Engineering, 51100, Niğde, Turkey, E-mail: tuncsiperb@nigde.edu.tr; Phone: +90 (388) 225-2204; Fax +90 (388) 2250112

Abstract

An experimental three-stage subsurface flow constructed wetland system was investigated for the removal of nutrient and organic matter from primary-treated domestic wastewater. Built in the Turkey Scientific and Technical Research Council-Marmara Research Center, Gebze, Turkey (Istanbul), the system consisted of a vertical flow-gravel filtration in the first stage, a horizontal-subsurface flow bed vegetated with *Iris* in the second stage, and a vertical-subsurface flow bed vegetated *Phragmites* in the third stage. Wastewater was recycled from the vertical bed to the horizontal one at a ratio of 1:2 and 1:1. The study aimed at evaluating the effects of the loading rates and seasonal changes, effects of recycling and rapid drainage, plant uptake, and the effectiveness of the system in the removal of organic matter and nutrients. The average removal efficiencies were high in summer periods. The results show that the average removal efficiencies increased depending on decrease in hydraulic loading rate and increase in recycle ratio. The relationships between the loading rate and the removal rate were linear.

Key words: hybrid systems, horizontal subsurface flow constructed wetland system, vertical subsurface flow constructed wetland system
