Full-scale hybrid constructed wetlands incorporated with an initial anaerobic stage for domestic wastewater treatment in a drinking water catchment area

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ABSTRACT

This study involves sequential treatment of domestic wastewater by anaerobic reactors followed by horizontal (HSSF-CW) and vertical (VSSF-CW) subsurface flow-constructed wetlands. Two full-scale systems constructed in two villages were operated in order to treat domestic wastewaters of about 2,000 and 500 inhabitants. Anaerobic treatment of domestic wastewater served as a pretreatment step before the constructed wetland (CW) systems. Anaerobic pretreatment was performed by an upflow anaerobic sludge bed reactor or an anaerobic baffled reactor. Anaerobically pretreated wastewater was first introduced into parallel HSSF-CWs and then parallel VSSF-CWs before being discharged. Efficient treatment of wastewaters of the two villages was particularly important since they are located in the watershed of a drinking water reservoir. The treatment efficiencies of systems were 88 and 83% for chemical oxygen demand, 89 and 81% for BOD₅, 57 and 39% for total nitrogen, 55 and 53% for total phosphorus, 94 and 90% for total suspended solids removal on average, respectively, in Balcik and Orucoglu villages. The effluent concentrations met the discharge limits. The study showed that hybrid CW system with anaerobic pretreatment is an effective method to treat domestic wastewaters of small communities with populations below 2,000.

Keywords: Anaerobic pretreatment; Domestic wastewater; Horizontal subsurface flow-constructed wetland (HSSF-CW); Vertical subsurface flow-constructed wetland (VSSF-CW)

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