

Abstract

Subsurface flow constructed wetlands are extensive urban waste water systems commonly applied in small communities (< 2,000 PE). An intrinsic property of these wetlands is the low dissolved oxygen concentration (< 1 mg/l) usually found in their bulk water. Physical transfer at the air - water interface and transport mediated by plants are the main oxygenation processes in the wetlands. In this study, the total oxygen transfer rate (OTR) in a horizontal subsurface flow constructed wetland (HSFCW) was determined experimentally by using a tracer gas method. Conventional gas bottles (containing a mixture of gases with 87% propane) were used for the purposes of the study, because of low costs. The mass transfer ratio (relationship between oxygen increase and propane decrease) was measured specially for the purposes of the study. The ratio was determined over time in tap water placed in a tank of 20 L and found to be 0,99.

Three experiments were carried out on a HSFCW located on the roof of the building of the Department of Hydraulics, Maritime and Environmental Engineering (Technical University of Catalonia). The wetland was operated with the following different hydraulic retention times 18,15 and 15 hours. Propane saturated water was pumped into the wetland. The OTR was determined basically with the observed differences in propane concentration between the inlet and the outlet. The propane concentration was measured with gas chromatography, applying a headspace technique. In the first two experiments the wetland was batch operated, while in the third there was a continuous flow. The values of OTR obtained for the three retention times were 2,08, 3,26 and 2,43 $\frac{g}{m^2*day}$ respectively. They are conform with the results obtained in previous studies. No major differences in OTR were found between the continuous and batch operations. In this study it has been proven that the developed methodology is suitable and reliable for quantification of the OTR in wetlands.

Keywords: oxygen transfer rate, subsurface flow constructed wetland ,oxygen mass transfer, tracer gas, propane, headspace technique