1 Introduction

Natural wetlands are complex biological systems that are especially valuable because of their huge biodiversity. An example of natural wetlands are floodplains with their typical rhythm of flooding and drying up. During the flood stage large amounts of nutrients are introduced in the wetland system. The wetlands have the ability to both retain and reduce these nutrients.

Constructed wetlands (CWs) take advantage of this ability. In these constructed systems similar biogeochemical reactions found in natural systems can take place in a defined and controlled space. The aim of waste water treatment to reduce and retain nutrient pollutants can be achieved in the wetlands. Part of the nutrients are transformed to biomass and enter the food chain. Therefore constructed wetlands have the potential to support wildlife. In wetlands of enough size and structural diversity, a high level of water treatment and a good wildlife performance can be achieved. [WPM97]

Wetlands have the advantage of low cost, easy operation and maintenance which makes them valuable for waste water treatment in developing countries. Waterborne diseases and pollution of the water resources can be prevented by employing wetlands for the treatment of domestic water [Den97]. In Europe small CW systems are very common for single households, farms or small communities (from 15 to 2000 PE)[PVS+07] . Larger constructions, for the treatment of industrial and agricultural effluent, landfill leachate, storm water and road runoff are commonly used in Australia and the USA. There are multiple uses for the effluent water of a CW. It can be used for irrigation of agricultural crops, watering of public and private gardens, flushing of toilets or cleaning. Another important reuse possibility, is the infiltration into the soil. The treated water can also be returned to the natural water circuit to supply existing natural wetlands and nature reserve areas. [RLS+08]

To achieve a good performance in waste water treatment, the construction of the wetland can be modeled or differently designed wetlands can be combined. One important point in modeling is the oxygen transfer to a wetland. A great part of the chemical reactions that are responsible for the nutrient reduction need an aerobic ambience.

Waste water has little dissolved oxygen (DO) but a high oxygen demand. The concentration difference causes an oxygen transfer from the atmosphere to the wetland. [KK96]The aim of this study was to determine the oxygen transfer to a subsurface flow constructed wetland with emergent plants situated at the Tecnical University of Catalonia in Barcelona.

Oxygen that enters a wetland is consumed immediately by reduction processes. Therefore a special measurement method has to be applied to determine the oxygen transfer rate. It can not be measured directly, that is why an indirect measurement with a tracer gas was chosen and employed in the present study. This work was based on preceding studies in the Netherlands, which employed the same method to determine the oxygen transfer to unplanted gravel beds. [San07]

2 Objectives

The main objective of the present study is to develop a cheap and easy applicable method for the measurement of oxygen transfer rates in subsurface flow constructed wetlands.

Specific objectives are to:

- Determine the value for the mass transfer ratio for the increase of oxygen and decrease of propane in water. This is necessary because a conventional gas (a mixture with 87% propane) was used instead of pure propane.

- Conduct a series of experiments in a wetland operated both in batch and continous flow devoted to the measurement of pure propane.

- Compare the observed oxygen transfer rates with those previously reported in other studies.