

## Greenhouse Gas Emissions from a Constructed Wetland System Treating Campus Wastewater in Southern Taiwan

Ying-Feng Lin\*, Shuh-Ren Jing, Rey-May Liou, , Chien-Chih, Lai

Department of Environmental Engineering and Science

Yih-Feng Chang

Department of Tourism Management, Chia-Nan University of Pharmacy and Science,

Tainan, 717, Taiwan, ROC

886-62660390, yflin@mail.chna.edu.tw

### ABSTRACT

Because global warming and climate changes are following upon an increase in atmospheric levels of greenhouse gases, there is intense concern with the sources and emissions of the gases. Constructed wetland technology is a natural treatment system for wastewater engineering and is characterized by the advantages of moderate capital costs and very low energy consumption and maintenance requirements. However, constructed wetlands are inherently the net source of greenhouse gases such as methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). Wetland construction and the area covered by constructed wetlands are increasing domestically and globally, thus there is an urgent need to elucidate the impact of constructed wetlands on atmospheric burden of these gases.

In a study period from December 2007 to April 2008, emission rates of nitrous oxide and methane as well as several parameters of water quality were simultaneously and monthly monitored at various sampling locations of a practical-scale constructed wetland system in Chia-Nan University of Pharmacy and Science, which has been operated for tertiary treatment of campus wastewater for near three years. This wetland system consists of a subsurface flow (SSF) wetland and followed by a free water surface flow (FWS) wetland with a total surface area of 3,800 m<sup>2</sup>. The objectives of the study were to: (1) investigate the temporal and seasonal variations in emission rate of greenhouse gases; (2) investigate the relationship between gas emissions and water quality of the constructed wetland to elucidate possible factors that can affect greenhouse gas emission; (4) investigate the day-night dynamic in greenhouse gas emission.

The results monitored in the first-half year study showed that emission rates ranged from -6.10 to 128.78  $\mu\text{g N}_2\text{O m}^{-2} \text{h}^{-1}$  and -4.17 ~ 44.4  $\text{mg CH}_4 \text{m}^{-2} \text{h}^{-1}$ . In temporal variation study, emission rate of either N<sub>2</sub>O or CH<sub>4</sub> was found to vary with the month as gas sampling. Up to now, the greatest emission rates of N<sub>2</sub>O were recorded in March, while the lowest rate were noted in February. The greatest emission rates of CH<sub>4</sub> were recorded in June, while the lowest rate were noted in February. The possible reasons for this phenomenon is temperature variation caused by seasonal change lead affect the biological processes responsible for gas emission in wetlands, resulting in the change of emission rate. To make a consistent conclusion, it is necessary to sustain the long-term study further so as to obtain statistically meaningful data.

Keywords: constructed wetlands, greenhouse gas, nitrous oxide, methane, wastewater treatment