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Organic matter, anion, and metal wastewater treatment in Damyang surface-flow constructed wetlands in Korea

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ABSTRACT

Surface-flow wetlands constructed with *Acorus* and *Typha* plants, connected to a wastewater treatment plant, were investigated with respect to organics (dissolved organic matter), anions (nitrate, sulfate, and phosphate), metals (Cu, Ni, Zn, Fe, and Mn), and metalloids (As). The results of the research indicated: (1) effluent organic matter (EfOM), based on dissolved organic carbon (DOC), was not efficiently removed by the wetlands. However, the hydrophobic, transphilic, and hydrophilic EfOM fractions varied throughout the wetlands, as identified by XAD-8/4 resins. (2) Nitrate, as compared to sulfate and phosphate, was efficiently removed, especially in the *Typha* wetland pond that had long retention time, under anoxic condition. (3) Most of the heavy metals were ineffectively removed via the wetland ponds. However, the iron concentration increased in the *Typha* wetland pond, which was probably due to its reduction under anoxic condition.

1. Introduction

Much research has been performed on constructed wetlands with respect to the control of organics, nutrients, and heavy metals, as well as many other components (Brix and Arias, 2005; Vymazal, 2005; Maine et al., 2006; Song et al., 2006). When constructed wetlands have previously been used for the treatment of wastewater effluents, they have generally exhibited high removal efficiencies for organics (60–99%), in terms of BOD and COD, and intermediate (sometimes low) efficiencies for nutrients, in terms of ammonia, nitrate, total phosphate, etc. (Brix and Arias, 2005; Vymazal, 2005). Kadlec and Knight (1996) and Kolka and Thompson (2006) investigated and summarized many case studies on the use of wetlands for the treatment of various contaminants, including organics, nutrients and heavy metals. They concluded that if constructed wetlands are properly built and effectively operated, they can provide good performance with regard to many different contaminants. It was unclear if certain constructed wetlands were designed especially for the control of heavy metals, but they have been found to exhibit good performance for selected metals (Maine et al., 2005, 2006).

Despite overall-investigative studies (i.e., removal trend by wetlands), research based more on the mechanistic characterizations of the performance of constructed wetlands is relatively rare (subject is research). Thus, further suggested research may include: (i) rigorous characterizations of organic matter (in terms of molecular weight, relative hydrophobicity, etc.) through various wetlands under different conditions, along with total organic mass control, (ii) nutrient control, mostly by biotic activities (e.g., nitrification or denitrification (Fleming-Singer and Horne, 2002)), and (iii) heavy metal control, by either biotic or abiotic activities.

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