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MODELING HIGH RATE P-REMOVAL IN A TWO-STAGE PILOT SCALE ALUM SLUDGE BASED CONSTRUCTED WETLAND SYSTEM

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Abstract

A system dynamics (SD) process based simulation model was developed using an object-oriented environment to simulate phosphorus (P) transformations in a two-stage pilot scale Dewatered Alum Sludge Cake (DASC) based Constructed Wetlands (CW), which is operated from February 2009 to January 2010 to treat relatively high concentration animal farm wastewater. Structural Thinking Experiential Learning Laboratory and Animation (STELLA v9.1.4) conceived on the principles of SD was used for the development of process based P model by constructing stock-flow diagrams and carrying out computer simulations using difference equations to integrate stocks and flows. From the model simulation it was found that the major pathways leading to permanent removal of P in a VFCW system in descending order were adsorption, plant uptake and microbial activities. Moreover the developed model has the ability to simulate the effluent P concentration. Model equations are presented and can be employed in numerical simulation to study optimum design strategies for a specific location with defined environmental conditions. Thus, the P process based model developed in this study could be used to explain the pilot scale P removal processes and also be used to simulate the fate of P in the animal farm wastewater treated in the DASC-VFCW.

Key words: adsorption, alum sludge constructed wetlands, phosphorus STELLA

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