Developing a system dynamics model for prediction of phosphorus in facultative stabilization ponds

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Abstract

System dynamics is considered as a computer-aided approach to policy analysis and design. It includes the response and reaction of a system to external shocks. In the present research, following the sampling and testing phases, a system dynamics model was developed for modeling of phosphorus in facultative stabilization ponds. First, the scheme of soluble reactive phosphorous stock, its specifications and parameters were determined and created in the VenSim PLE 7.1 software. Then, mathematical relations were determined for each process. Finally, the model was calibrated and verified based on the data from the Yazd facultative ponds, Iran. Sensitivity analysis showed that the most important factors affecting phosphorus concentration in the ponds are the phosphorus settling rate, losses caused by algal respiration and excretion, while the losses caused by herbivorous zooplanktons, hydrolysis rate of inorganic carbon, and ratio of phosphorus to chlorophyll-a had the least importance. Results showed that, algal growth rate and phosphorus settling rate were important factors in phosphorus removal. Hence, with appropriate retention time in the pond, it can be managed more properly. The ratio of phosphorus to algae had less importance in the model. The ratio of carbon to phosphorus and rate of respiration of carnivorous zooplanktons did not affect the phosphorus concentration. It is recommended that this model can be used for pond management and overall assessment of facultative ponds.

Keywords

Author Keywords: Phosphorus modeling; System dynamics modeling; Wastewater stabilization ponds; Facultative ponds