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Developing an Empirical Model for Evaluating Nutrient Removal Effectiveness at Wastewater Treatment Facilities

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Developing an Empirical Model for Evaluating Nutrient Removal Effectiveness at Wastewater Treatment Facilities

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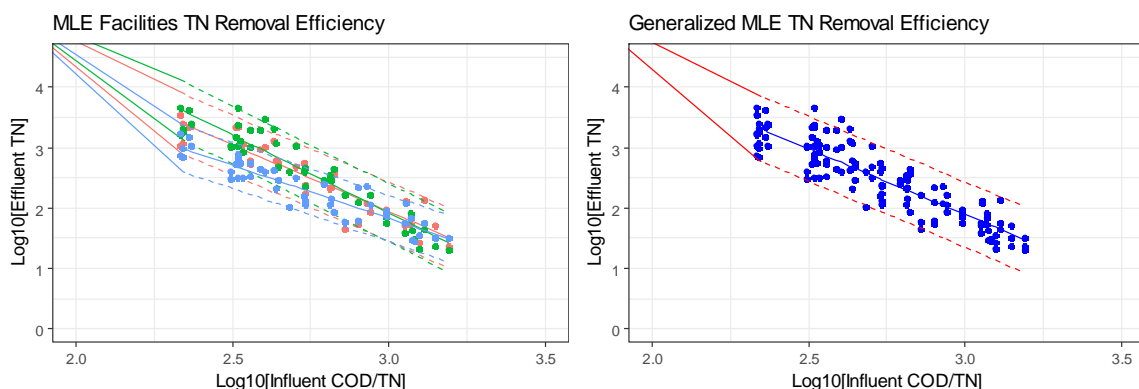
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Abstract: Many states are considering or have recently adopted nutrient regulations requiring wastewater treatment facilities (WWTFs) to improve existing treatment operations. Therefore, it is important for WWTF to be able to identify and evaluate factors that limit the effectiveness of nutrient removal efficiency. This is traditionally done using complex biological and chemical models of WWTF operations and requires a significant amount of data input, modeling experience, and time.

The purpose of this research is to provide a more effective way of evaluating factors that limit nutrient removal effectiveness. To accomplish this, an empirical model was developed to generalize the nutrient removal efficiency of various process configurations utilizing numerous scenarios in calibrated and validated wastewater treatment process models.

To develop this statistical model, a multilinear regression analysis was performed on the model output using the varied inputs acted as the explanatory variables. In all cases, the COD/TN was the most significant predictor of effluent water quality. Additional explanatory variables were considered for improvement of fit to the model results, but did not increase the overall regression fit of the empirical models. The regression analysis was first performed individually for each facility, and then the model results for all facilities were treated as a single data set and fit to a generalized model. The results provide an empirical model for predicting the achievable effluent nitrogen concentrations limited based on the influent water quality.



Linear Regression fit of TN Removal Efficiency Based on Influent COD/TN Relationship with 95% predictive confidence interval

Keywords: WWTF, process modelling, nutrient removal, empirical model