

عنوان مقاله:

Prediction of the waste stabilization pond performance using linear multiple regression and multi-layer perceptron neural network: a case study of Birjand, Iran

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خلاصه مقاله:

Background: Data mining (DM) is an approach used in extracting valuable information from environmental processes. This research depicts a DM approach used in extracting some information from influent and effluent wastewater characteristic data of a waste stabilization pond (WSP) in Birjand, a city in Eastern Iran. Methods: Multiple regression (MR) and neural network (NN) models were examined using influent characteristics (pH, Biochemical oxygen demand [BOD₅], temperature, chemical oxygen demand [COD], total suspended solids [TSS], total dissolved solid [TDS], electrical conductivity [EC] and turbidity) as the regression input vectors. Models were adjusted to input attributes, effluent BOD₅ (BOD_{out}) and COD (COD_{out}). The models performances were estimated by 10-fold external cross-validation. An internal 5-fold cross-validation was also used for the training data set in NN model. The models were compared using regression error characteristic (REC) plot and other statistical measures such as relative absolute error (RAE). Sensitivity analysis was also applied to extract useful knowledge from NN model. Results: NN models (with RAE = 78.71 ± 1.16 for BOD_{out} and 83.67 ± 1.35 for COD_{out}) and MR models (with RAE = $84.40\% \pm 1.07$ for BOD_{out} and 88.07 ± 0.80 for COD_{out}) indicate different performances and the former was better ($P < 0.05$) for the prediction of both effluent BOD₅ and COD parameters. For the prediction of COD_{out} the NN model with hidden layer size (H) = 4 and decay factor = 0.75 ± 0.03 presented the best predictive results. For BOD_{out} the H and decay factor were found to be 4 and 0.73 ± 0.03 , respectively. TDS was found as the most descriptive influent wastewater characteristics for the prediction of the WSP performance. The REC plots confirmed the NN model performance superiority for both BOD and COD effluent prediction. Conclusion: Modeling the performance of WSP systems using NN models along with sensitivity analysis can offer better understanding on exploring the most significant parameters for the prediction of system performance. The findings of this study could build the foundation for prospective work on the characterization of WSP operations and optimization of their performances with a view to conducting statistical approaches.

کلمات کلیدی:

Data mining, Multiple regression, Neural network, Waste stabilization pond

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