Predicting sanitary landfill leachate generation in humid regions using ANFIS modeling

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Abstract

Landfill leachate is one of the sources of surface water pollution in Selangor State (SS), Malaysia. Leachate volume prediction is essential for sustainable waste management and leachate treatment processes. The accurate estimation of leachate generation rates is often considered a challenge, especially in developing countries, due to the lack of reliable data and high measurement costs. Leachate generation is related to several variable factors, including meteorological data, waste generation rates, and landfill design conditions. Large variations in these factors lead to complicated leachate modeling processes. The aims of this study are to determine the key elements contributing to leachate production and then develop an adaptive neural fuzzy inference system (ANFIS) model to predict leachate generation rates. Accuracy of the final model performance was tested and evaluated using the root mean square error (RMSE), the mean absolute error (MAE), and the correlation coefficient (R). The study results defined dumped waste quantity, rainfall level, and emanated gases as the most significant contributing factors in leachate generation. The best model structure consisted of two triangular fuzzy membership functions and a hybrid training algorithm with eight fuzzy rules. The proposed ANFIS model showed a good performance with an overall correlation coefficient of 0.952.

Keywords