

Performance evaluation of slow sand filters using fuzzy rule-based modelling

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Abstract: The main objective of this study is to evaluate and predict the performance of slow sand filters used for wastewater treatment. The uncertainties in the control parameters and processes require fuzzy sets to be used when modelling system performance. Fuzzy logic if-then rules were used to build a model for the removal efficiency (total coliforms) of slow sand filters. The data were collected from three pilot-scale slow sand filters at the Alkhobar (Saudi Arabia) wastewater treatment plant. The removal efficiency of filters was modelled using three input control parameters - filtration rate, sand bed depth and grain size. Based on available data, fuzzy logic if-then rules were established. The fuzzy rule-based model was validated using experimental data of three case studies reported in the literature. The results were also compared with a multiple regression model. A possibilistic risk analysis was performed using optimal removal efficiency of the slow sand filters. The risk is estimated with respect to non-compliance of unrestricted agricultural reuse standards (100 total coliform/100 ml). In addition to slow sand filters, post- or pre-chlorination of wastewater is recommended to improve wastewater quality for conforming agricultural reuse standards. Crown Copyright © 2003 Published by Elsevier Ltd. All rights reserved