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A FRACTIONAL FUZZY SIMULATION METHOD FOR PREDICTING DISSOLVED TOLUENE AND OXYGEN CONCENTRATIONS IN AQUIFERS UNDER MICROBIAL ATTENUATION

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Abstract

This study proposes a modified fractional fuzzy simulation (MFFS) method to predict the toluene and oxygen concentrations in aquifers under microbial attenuation conditions. The method integrates the modeling of groundwater flow contaminant transport and fuzzy parameters analysis within a general framework. Compared to conventional fractional fuzzy simulation (FFS), decreased interior points of fuzzy parameters need to be used, thus reducing the simulation time. The method is applied to an aquifer of the Pinggu site in Beijing, China, where three parameters (i.e. longitudinal dispersivity, hydraulic conductivity and storage coefficient) are represented as fuzzy sets. Results from the case studies demonstrate that i) hydraulic conductivity has the most significant effect on toluene concentrations, while longitudinal dispersivity is rather significant, and storage coefficient has no apparent effect. ii) longitudinal dispersivity has the most significant effect on oxygen concentrations, while hydraulic conductivity is rather significant, and storage coefficient has no apparent effect. It is also observed that iii) the method is useful for not only site simulation, but also risk assessment, remediation design and process control under parameter uncertainty.

Key words: dissolved oxygen, fractional fuzzy simulation, groundwater flow, microbial attenuation, toluene transport

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