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A model for predicting permeability of geotextile envelope after combined clogging in arid areas

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The clogging problem of geotextile envelopes in subsurface drainage pipes in arid areas can lead to a reduction of the drainage capacity in the drainage system. The current research on combined clogging is mostly in the stage of phenomenological observations or indoor experiments, and quantitative methods are lacking. In this study, a model for predicting permeability of geotextile envelope was developed using pore distribution theory of geotextile envelope. Then, a stepwise coupled combined clogging model was proposed based on the evolution characteristics of physical and chemical clogging. The coupled model was verified by field sampling, and the measured results of the three sites were within the range of the predicted values. Then, the main factors affecting the combined clogging model of the geotextile envelope were analyzed, and the clogging evolution was predicted. The results showed that the combined clogging model was sensitive to the physical clogging coefficient β1 during the first 30 days and more sensitive to the calcium carbonate saturation index (SI) after 30 days of drainage. When β1 was equal to 0.3, a saturation index greater than 1.0, which corresponds to drainage mineralization exceeding 3.0 g/L, indicated a high risk of clogging in Xinjiang.