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Modeling the permeate transient response to perturbations from steady state in a nanofiltration process

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ABSTRACT

Knowledge of the transient response to perturbations from steady state is of importance in treatment processes in order to predict the time required to achieve the maximum effect of any feed water concentration change. Experimentation was conducted to evaluate the membrane permeate transient response for single-stage and three-stage nanofiltration membrane systems when each system's feed water experienced a perturbation in water quality with a sudden increase in chloride. The transient response of a single nanofiltration membrane was described by a first order system with a time constant of 3.8 min. The transient response to a permeate concentration change in a nanofiltration membrane process was 99% realized in 7 min. Mathematical models were developed that accurately described permeate chloride concentrations as a function of time after a step-change occurred in feed water chloride concentration levels feeding the systems. Results indicate that first order modeling is satisfactory for the description of the transient response of staged nanofiltration systems.

Keywords: Membrane; Transient response; Modeling; Permeate water quality