

Evaluation of second order and parallel second order approaches to model temperature variation in chlorine decay modelling

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ABSTRACT

All drinking water receives some form of disinfection and a minimum residual should remain at the customer's tap. Most popular disinfectant of all is chlorine. Chlorine reacts with compounds in water and hence leads to decay. Temperature is one of the important factors that control the rate of decay. Annual water temperature variations of more than 20°C are common in distribution systems, so that dosing needs to be adjusted substantially between seasons to maintain residuals within desired limits. Arrhenius equation has been successfully used to estimate the temperature effects on chlorine decay reactions, especially when temperature is below 30°C. The temperature dependence parameter estimated is activation energy (E)/universal gas constant (R). A number of chlorine decay tests were conducted, by varying temperature from 15–50°C. Resulting chlorine measurements were input into AQUASIM, data fitting was performed using the parallel second order model (PSOM) proposed by Kastl et al. [1] and second order model (SOM) proposed by Clark [2]. The model parameters for all modelling approaches were estimated using AQUASIM. PSOM has two reactants and two respective decay coefficients. Results showed that PSOM fitted the data very well when either single or two E/R s were used. On the contrary, the SOM did not show a good fit to the experimental chlorine decay profile for the same data sets. The results, therefore, indicated PSOM is more convenient to describe chlorine decay profile over a wide range of temperature.

Keywords: Disinfection; Chlorine decay; Second order model (SOM); Parallel second order model (PSOM); Temperature; Parameter estimation

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