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Drinking Water
Engineering and Science
Discussions

Interactive comment on "Comparison between constant and variable chlorine decay models applied to urban water supply network" *by* Ababu T. Tiruneh et al.

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We thank thr reviewer for for forwarding the evaluation. With due respect to the comment forwarded this is to make further clarification (not necessarily a defence against the comment) that the authors suggested a second order model for the variation of the decay rate constant with intial chlorine dose. The lireature availble mainly indicated emperical inverse relationship between the decay rate constant and the intial chlorine dose of the form K = 1/(a+bC0) where C0 is the intial chlorine and K is the first order decay rate constant. In many cases a graphical description or specification of a numerical range is given to narrate the relationship between intial chlorine and the first order

rate constant. We believe that our model started from the theooretical foundation of the dependence of the first order decay rate constant with intial chlorine modelled as a second order reaction of the form dK/dt = mK^2 in which the empirical inverse relation that we mentioned will be a consequence of this general model. It might be helpful to look at the theoretical background of our earlier paper

https://www.hindawi.com/journals/mse/2019/5863905/

that a gives a comprehensive theoretical justidfication of our proposed model of the second order nature of the variation of the first order decay rate constant with the intial chlorine dose. We also would like to state that present paralel two reactant second order models work with given intial chlorine dose along with water quality paremeters such as chlorine consuming reactantns. in other words, the fast and slow reaction rates Kf and Ks deribed from the model change whenever the initial chlorine dose changes. Leading authors recently suggested a way of handling this variation in this parallel two reactant model that takes accunt of the effect of intial chlorine dose. In this line it may be helpful to look at the paper by one of the leading researchers (Ian Fischer) who cited the need for research in this direction with the following link:

https://ascelibrary.org/doi/abs/10.1061/%28ASCE%29WR.1943-5452.0001101

We believe that our formal second order model over and above the empirical inverse relation we mentioned can be integrated in such models. We also compared the practical range within which the constant and variable rates modelling differ based on the model we developed and applying it to a real case of a water distribution system and provided the perecentage range within which the two models differ and the range of initial chlorine dose for which the percentage difference between the two models is/not significant. Several other researchers also indicated the need for formal modelling approach to the effect of intial chlorine dose and water quality on the decay rate constants suggesting a transition from the now mostly used empirical, regression based relationship.

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