

Multivariate modelling of disinfection kinetics: A comparison among three different disinfectants

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Received 29 October 2009; Accepted in revised form 22 November 2010

ABSTRACT

Disinfection kinetics has been extensively discussed in scientific literature, however, most of the studies refer to batch reactor experiences and mostly to potable water. Only few authors have compared batch kinetics to continuous flow performances and even fewer are the studies where kinetic models are provided with complete regression statistics. Aim of this study was to apply multivariate regression analysis to model the inactivation kinetics of three different disinfectants: sodium hypochlorite (NaClO), peracetic acid (PAA) and ozone (O₃). The inactivation of the three disinfectants has been studied on pilot-scale continuous-flow reactors fed with a secondary effluent of a full scale wastewater treatment plant. *Escherichia coli*, total and faecal coliforms were used as microbial indicators. The accuracy of the most commonly used inactivation models (i.e. Chick–Watson, Selleck, and Hom) was tested and compared. The goodness of fit of each model was evaluated and the inactivation parameters were determined for each disinfectant–indicator combination. The best-fit models for NaClO and O₃ inactivation kinetics were based on Hom’s formula whereas PAA inactivation was found to be better modeled by the more recently described “S-model”. Regression analysis outlined the dominance of disinfectant dosage over contact time for NaClO and PAA and the lack of such a dominance for O₃. Furthermore, whereas the inactivation kinetics of the three microbial indicators resulted to be comparable for NaClO and O₃, a faster inactivation was shown for *Escherichia coli* with PAA suggesting a inactivation mechanism different from total and faecal coliforms. This result is extremely relevant since Italy in 2000 replaced *Escherichia coli* to total and faecal coliforms as microbial indicator to assess the water quality requirements of surface waters and reused wastewaters and PAA is increasingly preferred as disinfectant agent to hypochlorite and ozone.

Keywords: Disinfection kinetics; Ozone; Peracetic acid; Sodium hypochlorite; Multivariate analysis

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