Numerical Simulation of Ultraviolet Disinfection in a Water Reactor

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Abstract : In recent years, experimental and numerical investigation of water UV reactors has increased significantly. The main drawback of experimental methods is confined and expensive survey of UV reactors features. In this study, a CFD model utilizing the eulerian-lagrangian framework is applied to analysis the disinfection performance of a closed conduit reactor which contains four UV lamps perpendicular to the flow. A discrete ordinates (DO) model was employed to evaluate the UV irradiance field. To investigate the importance of each of lamps on the inactivation performance, in addition to the reference model (with 4 bright lamps), several models with one or two bright lamps in various arrangements were considered. All results were reported in three inactivation kinetics. The results showed that the log inactivation of the two central bright lamps model was between 88-99 percent, close to the reference model results. Also, whatever the lamps are closer to the main flow region, they have more effect on microbial inactivation. The effect of some operational parameters such as water flow rate, inlet water temperature, and lamps power were also studied.

Keywords : Eulerian-Lagrangian framework, inactivation kinetics, log inactivation, water UV reactor

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