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Comparing Results from OpenFOAM and ANSYS FLUENT with Physical Tracer Study in A Hairpin-Shape Ozone Contactor for Water Treatment

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Ozone contactors are a commonly used facility for drinking water disinfection. The contactor tank geometry can lead to hydraulic inefficiency through recirculation zones and short circuiting. The capability of predicting hydraulic and disinfection efficiencies of ozone contactors is essential for evaluating existing contactors and verifying new designs. Many CFD models have been developed to study the physical, chemical, and biological processes in ozone disinfection contactors in the last decade (Zhang et al. 2014a). The majority of these CFD models were based on commercial software such as ANSYS FLUENT, ANSYS CFX, and COMSOL. But open-source code, such as OpenFOAM, has shown promising results in simulating the processes in ozone contactors (Zhang et al. 2014b, 2016, 2019). To further demonstrate the capability of OpenFOAM in studying the processes in ozone contactor, this study developed CFD models for the full-scale ozone disinfection contactor at a water treatment plant in California, United States, based on both ANSYS FLUENT and OpenFOAM. The ozone disinfection contactor in this study is a relatively new design in which use a stacked serpentine flow path rather than a single vertical or horizontal plane serpentine path. Both the ANSYS FLUENT and OpenFOAM models used the same mesh, which was determined by a grid independence study, and the same turbulence model (i.e., realizable K-epsilon model). Velocity contours from ANSYS FLUENT and OpenFOAM at key locations are compared, showing some agreements and some discrepancies. The potential reasons for the discrepancies will be explored in the presentation. Both ANSYS FLUENT and OpenFOAM were used to simulate the passive tracer transport in the ozone contactor following the physical tracer test conducted previously. The residence time distributions generated from the physical and numerical tracer studies will also be compared and discussed in this presentation.

References:

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