Numerical Simulation of Solar Reactor for Water Disinfection

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Abstract : Mathematical modeling and numerical simulation have emerged over the past two decades as one of the key tools for design and optimize performances of physical and chemical processes intended to water disinfection. Water photolysis is an efficient and economical technique to reduce bacterial contamination. It exploits the germicidal effect of solar ultraviolet irradiation to inactivate pathogenic microorganisms. The design of photo-reactor operating in continuous disinfection system, required tacking in account the hydrodynamic behavior of water in the reactor. Since the kinetic of disinfection depends on irradiation intensity distribution, coupling the hydrodynamic and solar radiation distribution is of crucial importance. In this work we propose a numerical simulation study for hydrodynamic and solar irradiation distribution in a tubular photo-reactor. We have used the Computational Fluid Dynamic code Fluent under the assumption of three-dimensional incompressible flow in unsteady turbulent regimes. The results of simulation concerned radiation, temperature and velocity fields are discussed and the effect of inclination angle of reactor relative to the horizontal is investigated.

Keywords : solar water disinfection, hydrodynamic modeling, solar irradiation modeling, CFD Fluent

Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020