

Numerical Study of UV Irradiation Effect on Air Disinfection Systems

Authors : H. Shokouhmand, M. Degheh, B. Sajadi, H. Sobhani

Abstract : The induct ultraviolet germicidal irradiation (UVGI) systems are broadly used nowadays and their utilization is widened every day. Even though these systems are not applicable individually, they are very suitable supplements for the traditional filtration systems. The amount of inactivated microorganisms is dependent on the air velocity, lamp power, fluence rate distribution, and also germicidal susceptibility of microorganisms. In this paper, these factors are investigated utilizing an air-microorganism two-phase numerical model. The eulerian-lagrangian method was used to have more detailed information on the history of each particle. The UVGI system was modeled in three steps including: 1) modeling the air flow, 2) modeling the discrete phase of particles, 3) modeling the UV intensity field, and 4) modeling the particle inactivation. The results from modeling different lamp arrangements and powers showed that the system functions better at more homogeneous irradiation distribution. Since increasing the air flow rate of the device results in increasing of particle inactivation rate, the optimal air velocity shall be adjusted in accordance with the microorganism production rate, and the air quality requirement using the curves represented in this paper.

Keywords : CFD, microorganism, two-phase flow, ultraviolet germicidal irradiation

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

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020