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A computational fluid dynamics study of the infectiousness decay of SARS-CoV-2 microorganism when exposed to UVGI combined with evaporation

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Respiratory diseases propagated by droplet-based transmission are serious public health hazard, leading to pandemics, such as the Coronavirus outbreak. One engineering intervention used to mitigate the spread of droplet-based transmission pathogens is ultraviolet germicidal irradiance (UVGI). The UVGI device is able to disinfect air and surfaces through intense ultraviolet germicidal irradiance, which damages infectious microorganisms. This process coupled with environmental conditions such as evaporation helps to reduce the spread of aerosol transmission of pathogens. Despite tremendous research progress on mitigation of the spread of infectious diseases reported, there is no adequate information on the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infectiousness decay when exposed to UVGI combined with evaporation process. In this study a computational fluid dynamics (CFD) simulation with the combination of parameters describing the UVGI intensity field, humidity, temperature and relative motion (droplet and fluid) was used to investigate the infectiousness decay of SARS-CoV-2 in a confined room. Droplets propagating SARS-CoV-2 were tracked using the discrete phase model as implemented in ANSYS-FLUENT. Augmentation of the standard models were developed as using an external scalar to track infectiousness via a user define function so as to determine the survival rate and the infectiousness decay of droplets propagating SARS-CoV-2 at specific relative humidity and temperature values, during coughing, speaking, and sneezing of a carrier in a confined room. The infectiousness of SARS-CoV-2 significantly reduced when exposed to UVGI coupled evaporation. Therefore, we suggest that the spread of the infectiousness of SARS-CoV-2 in a confined room can be investigated using our proposed model. Furthermore, we show that our model can be used to optimize engineering interventions, thus forming the basis of understanding and controlling infectiousness of droplets propagating SARS-CoV-2 in a confined public health space. In the future, our model proposed in this study can be extended to mitigate the spread of other infectious airborne diseases in public schools, clinics, and transport systems

Apply to be considered for a student ; award (Yes / No)?

No

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No

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