OMICS Group Conferences
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International Conference and Exhibition on
Mechanical & Aerospace Engineering
September 30-October 02, 2013 Hilton San Antonio Airport, TX, USA

Air quality in localized air-conditioned spaces utilizing upper-room UVG

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The aim of this work is to check the performance of an upper room ultraviolet germicidal irradiation (*UVGI*) system operated with a localized ceiling-mounted air-conditioning system. Renewed interest emerged in upper-room *UVGI* due to ability to kill microorganisms while reducing the energy consumption associated with ventilation. The conditioned space is modeled using detailed computational fluid dynamics (*CFD*) software while incorporating *UV* intensity distribution to predict the *UV* dose and bacteria concentration in the supply and return stream. The *CFD* simulation of the space calculates the concentration distribution of the microorganism and incorporates their inactivation in presence of an ultraviolet (*UV*) field. The *UV* field is calculated using a published predictive model and compared to measurements performed using actinometry. The effectiveness of the UVGI system is then studied for two microorganisms: Bacillus subtilis and Escherichia coli and evaluated by the decrease, due to the UV field, in the microorganism concentration of the room return air. Moreover, *CFD* simulations are performed to determine an equivalent ventilation rate of the used air distribution system that will produce the same air quality in the room without use of UVGI. It was found that the killing rates of up to 71 % for B. subtilis and up to 92 % for E. coli were achieved with the use of the UVGI.

Biography

Mohamad Kanaan is a Ph.D. student at the American University of Beirut at the Department of Mechanical Engineering.

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