

THREAT AGENT DEFEAT MODELING AND TESTING

Aerosol Particle Size Is Important In Designing And Testing Uv Systems For Inactivation Of Bacterial Spores And Viruses As Seen In Modeling Of Uv Shielding

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Ultraviolet germicidal irradiation (UVGI) is effective in inactivating microbes such as viruses and bacterial spores. Bacterial spores within aerosol particles can be partially protected from UVGI (Kesavan et al., 2014). Shielding of viruses within particles from UVGI has been demonstrated in calculations of UV intensities using the Multi-Sphere T-Matrix (MSTM) method and in calculated reductions in survival fractions (Doughty et al., 2021; Hill et al., 2021). Here we use the Multi-Sphere T-Matrix method (MSTM) to model the shielding of bacterial spores (approximated as homogeneous spherical particles) in clusters, which may be encased within a host sphere. Results are shown for clusters in air or on a planar surface composed of polycarbonate, iron or aluminum. The wavelengths used are 266, 302, 325 and 450 nm. The calculated shielding for 5- and 9- μ m host spheres is illustrated. The effects of absorption by the host sphere or by other spores in the cluster, and the effects of refraction of UV light at the host surface and of scattering within the particles are discussed. The extent of the shielding from UV illustrated indicates that the inclusion of microbes within clusters and/or host particles can lead to increased survival of microbes even if the host particle is not absorbing. These calculations illustrating UV shielding and its dependence on particle size suggests that the size ranges of the particles responsible for disease transmission need to be determined and included when designing UVGI inactivation systems and when testing them for efficacy.

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Hill SC, Mackowski, DW, Doughty DC. 2021. Shielding of Viruses such as SARS-CoV-2 from Ultraviolet Radiation in Particles Generated by Sneezing or Coughing: Numerical Simulations of Survival Fractions. *J Occup Environ Hyg*, <https://doi.org/10.1080/15459624.2021.1939877>

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