



# Environmental Engineering & Sciences

Department of Civil and Environmental Engineering  
Spring '24: CEE 595AG Seminar

Friday, February 9, 2024 | 10:00 – 10:50 a.m. CST | 3310 Yeh Center

## Molecular Mechanisms of Inactivation By Relative Humidity and UV Disinfection for Respiratory Viruses In Indoor Conditions

Respiratory virus transmission causing outbreaks like the COVID-19 pandemic and seasonal flu strains healthcare systems and leads to economic and social upheaval. The inactivation of virus-containing aerosols based on environmental factors and UV disinfection affects effective monitoring of indoor respiratory virus transmission. Relative humidity (RH) affects aerosol particle sizes and, thus, particle suspension time and viral infectivity. Depending on virus types, strains, or spraying medium, relationships between RH and viral aerosol inactivation can be monotonic, V-shaped, or unrelated. RH also affects ultraviolet (UV) efficacy. The susceptibilities of viruses to UV exposure vary with RH fluctuation. Considering these complicated trends between RH fluctuation, viral aerosol inactivation, and UV efficacy for different viruses, we focus on the biological mechanisms of inactivation by RH and UV disinfection. We propose that mechanistic explanation remains similar for one virus family, considering the similar genome and structure. Our study addresses viral aerosol inactivation and UV disinfection mechanisms by examining viral-host receptor interactions, capsid integrity, viral genome integrity, and overall virus infectivity across a spectrum of RH levels. Currently, we have found RH did not disrupt PRCV-receptor interactions but influenced capsid integrity and genome stability. A comparative analysis of viral genome quantities using one-step-qPCR assays and viral replication assessed by plaque forming units showed that the qPCR assays tended to overestimate aerosolized virus concentrations. Current findings contribute to understanding optimal indoor relative humidity conditions for reducing the spread of aerosolized coronaviruses and provide a basis for practical guidelines in indoor environments. Further study will optimize UV application by adjusting RH to increase UV efficacy on specific viruses to prevent viral aerosol spreading.

**Aijia Zhou**  
**PhD Candidate**  
Advisor: Helen Nguyen



### Biography

Aijia Zhou is a 3rd Ph.D. student in Prof. Nguyen's lab. Her area of research includes the inactivation of aerosolized viruses by environmental factors and UV disinfection. Aijia earned her bachelor's degree in environmental science from Tongji University, China, and a Master's degree in Environmental Engineering from the UIUC. She joined UIUC and Prof. Nguyen's lab in 2019. In her spare time, Aijia enjoys playing with her cat, Pluto.