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# Respiratory Bioaerosol Dynamics: Impact of Salinity on Evaporation

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**Abstract :** In the realm of infectious disease research, airborne viral transmission stands as a paramount concern due to its pivotal role in propagating pathogens within densely populated regions. However, amidst this landscape, the phenomenon of hygroscopic growth within respiratory bioaerosols remains relatively underexplored. Unlike pure water aerosols, the unique composition of respiratory bioaerosols leads to varied evaporation rates and hygroscopic growth patterns, influenced by factors such as ambient humidity, temperature, and airflow. This study addresses this gap by focusing on the behaviors of single respiratory bioaerosol utilizing salinity to induce saliva-like hygroscopic behavior. By employing mass, momentum, and energy equations, the study unveils the intricate interplay between evaporation and hygroscopic growth over time. The numerical model enables temporal analysis of bioaerosol characteristics, including size, temperature, and trajectory. The analysis reveals that due to evaporation, there is a reduction in initial size, which shortens the lifetime and distance traveled. However, when hygroscopic growth begins to influence the bioaerosol size, the rate of size reduction slows significantly. The interplay between evaporation and hygroscopic growth results in bioaerosol size within the inhalation range of humans and prolongs the traveling distance. Findings procured from the analysis are crucial for understanding the spread of infectious diseases, especially in high-risk environments such as healthcare facilities and public transportation systems. By elucidating the nuanced behaviors of respiratory bioaerosols, this study seeks to inform the development of more effective preventative strategies against pathogens propagation in the air, thereby contributing to public health efforts on a global scale.

**Keywords :** airborne viral transmission, high-risk environments, hygroscopic growth, evaporation, numerical modeling, pathogen propagation, preventative strategies, public health, respiratory bioaerosols
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