ABSTRACT

Quantifying the Relationship Between Physicochemical Properties and Biological Decay in Populations of Bioaerosol Droplets

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The evaporation and rehydration processes occurring during a droplet's lifetime produce rapid changes in the particles' size that will affect most of the physicochemical properties of the biological aerosol (i.e. solute concentration, density, viscosity, temperature etc.). These dynamics could also impact the viability of the microbes contained within the bioaerosol droplets and will influence the length of time microorganisms survive during aerosol transport. To be presented is a novel approach to probe aerosols containing *Escherichia coli* MRE162 that can be extended to other microorganisms. It combines two different technologies to interconnect the complexity of aerosol dynamics with bioaerosol longevity as a function of time, environmental conditions and aerosol composition, aiming to fully understand the mechanisms of airborne transmission.

The CK-EDB (Comparative Kinetics Electrodynamic Balance) and CELEBS (Controlled Electrodynamic Levitation and Extraction of Bio-aerosol onto a Substrate) technologies are based on Electrodynamic Balance Levitation for droplet suspension and utilize droplet-on-demand aerosol generators to produce droplets with high monodisperse size distribution (Fernandez et al., 2019). By using the CK-EDB, it is possible to measure the changes in the physicochemical properties of the bio-aerosol droplets during the drying and thermodynamic equilibrium processes with the aim to ultimately interrelate this information with the biological decay responses measured by the CELEBS.

Results outlined in this presentation will contribute to understand the impact of several variables such as: (a) evaporation kinetics, (b) changes in aerosol composition, (c) presence of surfactants and (d) changes in droplet temperature on the longevity of E. *coli* in the aerosol phase, featuring some of the benefits of this novel methodology including: (1) the characterization of the first phase of microbial death during evaporation; (2) quantifying the complete droplet composition, from the single droplet to the population level; (3) minimizing stresses during bioaerosol aerosolization and sampling

SUPPORTING INFORMATION

My contribution to this work: My platform presentation on the AAAR 37th Annual Conference is based on the research work I have carried out during the first three years of my PhD in the lab of Prof. Jonathan P. Reid at the University of Bristol, UK.

Research in the remit of the Aerosol Society: In these studies, we investigate how aerosol dynamics could impact the viability of microbes contained within the bioaerosol droplets. This work will enable us to address some of the fundamental questions regarding the dynamics of disease transmission in the aerosol phase.

Benefits from attending the event: Attendance at the AAAR 37th Annual Conference would be extremely useful as would enable interaction with potential collaborators and facilitate discussion with scientists in the same field. Furthermore, it would be extremely valuable to attend sessions on related work to appreciate where similar work being undertaken and to identify where there are knowledge gaps and therefore scope for further work.

Breakdown of other awards, contributions, grants or funds applied for: PhD research funding available through my NERC-NCAS scholarship (£500 available).

Level of funding required from The Aerosol Society: kindly request £500 to be able to cover part of the travelling expenses.

Visa required: No