6BA.5
Probing the Fundamentals of Bioaerosol Longevity as a Function of Atmospheric and Particle Compositions through Using a Next Generation Electrodynamic Balance.
ALLEN E. HADDRELL, Mara Otero, Richard Thomas, Jonathan P. Reid, *University of Bristol*

The study of the fundamentals of bioaerosol is challenging. Firstly, there remain all the challenges associated with standard aerosol experiments (small sample size, broad concentration ranges), with the additional difficulty of studying the variability presented by micro-organisms residing in droplets (e.g. population variation, chemical composition). The methodologies currently employed in laboratory studies of bioaerosol are based on analytical approaches developed in the 1950s with minor adaptations (e.g. Goldberg drum). Numerous aspects of these technologies are problematic, from droplet generation (retaining viability, knowing chemical and biological composition (Zhen, 2014)), droplet suspension (avoiding wall loss, interaction with contaminants, etc.) and analysis (sampling inefficiency). Given these limitations, some basic questions about bioaerosol have yet to be fully answered (e.g. does the number of bacteria or chemical composition in a droplet influence the longevity and transmissibility of micro-organisms in the droplet?).

To be able to answer these fundamental questions, a novel technology has been developed and will be presented. This technology (utilizing electrodynamic levitation) produces and suspends a quantifiable number of near identical bioaerosol droplets within an atmosphere whose composition is controlled. Moreover, the complete chemical and biological composition of the droplets is tailorable. After a given period the droplets are extracted from the gas phase (at a 100% efficiency) onto a substrate wherein their viability is probed.

Of the many unique characteristics of this technology, the ability to produce droplets with identical chemical composition and size, with a similar absolute number of microorganism (±10%), is critical to being able to answer the most fundamental questions regarding bioaerosol. Some of the measurements to be presented include, the effect that the (a) absolute number of bacterium per droplet, (b) environmental parameters (e.g. relative humidity, temperature, solar irradiation), (c) biological species, and (d) chemical composition of the droplet itself, will have on longevity and infectivity.

Zhen, H. J.et al, G. J Aerosol Sci 2014, 70, 67.

6BA.6
Evaluation of a Self-Contained Personal Electrostatic Bioaerosol Sampler (PEBS) for Bioaerosol Collection.
TAEWON HAN, Nirmala Thomas, Gediminas Mainelis, *Rutgers, The State University of New Jersey*

We recently developed a new personal electrostatic bioaerosol sampler (PEBS) for determining exposures to airborne microorganisms. The PEBS was shown to effectively collect airborne biological particles while producing very low ozone concentrations. Here we analyzed the performance of this sampler with two airborne microorganisms - Bacillus atrophaeus bacterial cells and Penicillium chrysogenum fungal spores - as a function of sampling flow rates (e.g., 10 and 20 L/min) and sampling time (e.g., 10, 60, and 240 min). The PEBS was also tested against the BioSampler and the Button Aerosol Sampler (both SKC Inc., Eighty Four, PA) when sampling bioaerosols outdoors for 240 min at a standard flow rate of each sampler (10, 12.5, and 4 L/min, respectively). The bioaerosols drawn into the PEBS were deposited on a collection metal plate coated with a superhydrophobic substance and were then removed by 5 mL of liquid medium (water or phosphate-buffered saline). The sampler’s physical collection efficiency, viability and culturability of collected microorganisms were determined using microscopy, adenosine triphosphate (ATP), flow cytometry (Live/Dead test), and culture techniques.

The collection efficiency of PEBS was approximately 80% when sampling B. atrophaeus bacteria and P. chrysogenum fungal spores at 10 L/min for 10 min and at ~10^4/Liter airborne concentrations. The sampler also showed similar and steady collection efficiency (on average 83%) during 4-hour sampling period and produced low ozone concentration (< 10 ppb). Further, cell viability and culturability of the PEBS was expressed as Relative Luminescence Units (ATP method), a ratio of Live/Dead cells (flow cytometry), and Colony Forming Units, and compared against that of the two reference samplers when sampling for 10 and 240 min. The average ratios of Live/Dead cells of PEBS when collecting the microorganisms were similar or better compared to those of BioSampler and Button Aerosol Sampler.