Comparison of bacterial communities in coastal bioaerosols collected with AirCube and Coriolis air samplers

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Understanding the composition and diversity of airborne microbes is essential due to their role in atmospheric processes, climate change and public health. Thus far, studies of airborne microbes have focused primarily on culture-dependent methods, which can only identify a small fraction of the actual microbes because most environmental microbes cannot be cultured by standard techniques. High-throughput sequencing (HTS) methods enable the detection of unculturable and undiscoverable microbes and provide detailed insights into their diversity and function. However, collecting sufficient biomass of bioaerosol samples for bacterial community studies by HTS is challenging because the air is an extremely biologically diluted environment. There are many commercially available air samplers, differing in sampling principles, performance characteristics (e.g., cutoff size, sampling flow rate and duration, collection medium, etc.), ability to preserve critical bioaerosol properties and compatibility with various analysis methods. Currently, few studies have compared their performances in the investigation of airborne microbial communities. In this study, we evaluated two kinds of air samplers, AirCube HE and Coriolis μ, in bioaerosols collection for airborne bacterial community analysis by Nanopore full-length 16S rDNA sequencing. AirCube HE is a filtration impactor. It connects to a filter holder and pumps air particles onto a filter membrane. It takes several days to collect enough bioaerosols due to its low air sampling rate (5–50 L/min). During this time, the continuous filtration stress on the already collected microbes might lead to changes in bacterial community. Coriolis μ is a liquid cyclonic impactor. It draws air into a liquid-filled sampling cone; airborne particles are pulled against the wall by centrifugal force and stay in the collection liquid. Coriolis is regarded as relatively high-efficient, its air sampling flow rate varies from 50 to 300 L/min, which has the potential for high time-resolution studies. We conducted coastal bioaerosol sampling activities on the roof of Marine Station Oostende (MSO) to avoid the interference of anthropogenic activities. Bioaerosol samples were collected using AirCube with two types of filters and using Coriolis with Milli-Q water for different sampling durations. The effects of filter types and sampling devices on bioaerosols collection efficiency and bacterial community were analyzed. Our results provide useful information about AirCube and Coriolis for coastal bioaerosol sampling and highlight their differences in the collection efficiency and bacterial community studies.

Keywords
Coastal Bioaerosol; Sampling Device; Airborne Bacterial Community; Nanopore Sequencing