Abstracts

Poster: 0179

Performance of Portable Microbial Samplers for Estimating Human Exposure to Airborne Biological Agents

M Yao (1), G Mainelis (1) presenting

Rutgers University, New Brunswick, NJ, United States (1)

Portable microbial samplers are becoming popular for estimating human exposure to airborne biological agents, which are known to present a significant health impact. However, not much informationis available about the performance of these samplers. This research investigated the collection efficiencies and inhalation conformities of seven portable microbial samplers: MAS-100, Microflow, SMA MicroPortable, Millipore Air Tester, SAS Super 180, BioCulture, and RCS High Flow. Their physical efficiencies and adherence to the inhalation standards were investigated using aerosolized Polystyrene Latex (PSL) particles and six species of bacteria and fungi. Biological efficiencies of the samplers were also studied and compared with two reference samplers (Andersen-type impactor and Button Aerosol Sampler) by collecting anthrax simulant Bacillus subtilis and other biological agents under controlled humidity level of 40-45%.

Experimental results have shown that all evaluated samplers collect approximately 5% or less of 0.5µm particles. The effective cut-off size, or d50, of the investigated samplers ranged from 1.2µm for the RCS High Flow, 1.7 µm for the MAS-100, 2.1 µm for the SAS Super 180, to 2.3 µm for the Millipore Air Tester; for other three samplers the cut-off sizes were above 5.2 µm. The cut-off size of a bioaerosol sampler indicates the size at which 50% of the particles are collected. In addition, the RCS and the SAS Super 180 samplers were found to match the inhalation curve fairly well when sampling fungal spores, but not bacterial species. The RCS sampler was also found to be able to reflect the pattern of particle deposition in the lung when sampling both bacterial and fungi species. The MAS-100 and the SAS Super 180 samplers were found to match fairly well the total lung deposition curve when collecting bacterial and fungi species, respectively. Biological efficiency tests with B. subtilis have shown that the reference sampler Button Aerosol Sampler with gelatin filter performs best among the samplers tested. The RCS High Flow and the reference Andersen-type impactor recovered about 40% less culturable B. subtilis compared with the Button Aerosol Sampler; recovery of B. subtilis by other samplers was substantially lower.

This study indicated that most of the currently available portable microbial samplers have limited ability to collect smaller bacterial species because of their large cut-off sizes. Therefore, their results

pertaining to human exposure to bacteria have to be treated with caution, and research leading to modern tools capable of efficiently measuring exposure to bacteria is urgently needed. For heavily contaminated sites, the Button Aerosol Sampler with gelatin filter may perform best in terms of biological efficiency. The RCS High Flow and the BioStage samplers, however, might be more suitable for sampling less contaminated air based on their high sampling flow rates and relatively higher recovery of culturable bioaerosols.

The results from this study will help researchers in making decisions when selecting samplers for bioaerosol sampling and detection studies, thus providing better assessment of human exposure to the biological agents.

NORA Symposium 2006

Research Makes a Difference

April 18-20, 2006

L'Enfant Plaza Hotel

Washington, DC

NORA

CDC Workplace Safety and Health

NIOSH

National Safety Council