Estimation of Airborne Subtilisins concentrations using a Real-Time Grimm Portable Aerosol Monitoring Instrument

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ABSTRACT

Objectives: Currently, there is no real-time method for measuring occupational exposure to subtilisin enzymes. This study investigated whether a Grimm 1.109 Aerosol Spectrometer could be used to estimate airborne concentrations of subtilisin enzymes in real-time as compared to an SKC Personal Button sampler.

Methods: A comparative study was conducted relating the concentration of subtilisin enzymes in detergent as measured by SKC Button Inhalable Aerosol Samplers when compared to Grimm 1.109 Aerosol Spectrometer particulate concentrations. Enzyme concentration from the Button Sampler was determined using a Thermo Scientific Konelab Arena 20 photometric analyzer. Linear regression and Pearson’s correlation comparing the concentration of enzyme collected from the Button Sampler filter to total particulate concentrations measured by the Grimm were performed for sampling events conducted in the enclosure. A 2% enzyme and detergent mixture of <25 µm particle diameter was routinely introduced into the enclosure for sampling. Additionally, linear regression and Pearson’s correlation comparing the concentration of total aerosol, as determined by gravimetric analysis, collected by the Button Samplers to total particulate concentrations measured by the Grimm was performed for all sampling events.

Results: Results of the linear regression analysis of the Grimm aerosol data and Button Sampler data for enzymes obtained during the enclosure sampling events show a strong relationship between the two methods ($R^2=0.922 [0.001], r=0.96 [0.001]$). Relating the gravimetric analysis of total aerosol collected on the filters also shows a strong relationship ($R^2=0.98 [0.001], r=0.99 [0.001]$) when compared to the Grimm.

Conclusion: Results of this study demonstrate that a strong association exists between the Grimm and Button Sampler for enzymes, when sampling was carried out in the enclosure with particles of known size and concentration. Additionally, the Grimm shows a strong association with the Button Samplers for inhalable sized particles based on gravimetric analysis.