stantially affected the indicated aerodynamic size distribution of both bioaerosols, with greater effect seen for the gram-positive *B. subtilis* than for the gram-negative *P. fluorescens*. The effects were most pronounced above 80% RH. Further, *B. subtilis* aerosol size distribution was affected by RH even in the absence of phosphate buffer while *P. fluorescens* was not, suggesting a species-related difference in hygroscopic behavior.

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ENSURING ACCURACY IN INDOOR AIR QUALITY INVESTIGATIONS INVOLVING MICROBIAL CONTAMINATION; HOW TO INTERPRET AIR SAMPLING DATA. G.D. Boothe, Gobbell Hays Partners, Inc., Nashville, TN

Fungal contamination of building components in occupied spaces can lead to amplification of airborne concentrations of fungal spores. Allergic reactions to airborne fungal spores have been well documented. This presentation summarizes the findings from several indoor air quality (IAQ) studies that included microbial contamination of building products in occupied spaces. Some interior spaces contained obvious visible microbial growth while others did not exhibit any visible growth on interior surfaces. It has been standard practice in IAQ investigations to obtain air samples for fungal spores when fungal contamination is suspected. This paper examines the accuracy of determining amplification in a facility based on air sampling alone.

Air samples were collected in more than 125 occupied spaces using an Andersen single-stage viable impactor. Each space was characterized for visible growth, temperature, and relative humidity. In some cases inaccessible wall cavities were viewed using a borescope to determine whether microbial growth was present. The analytical results from sampling in occupied spaces were compared with background samples to determine whether amplification existed in the units. An attempt was made to correlate amplification of airborne viable fungal spore concentrations with the presence and quantities of visible fungal growth in the occupied space. Statistical analyses of the data show a significant increase in differences between airborne viable fungal spore concentrations in spaces with significant visible growth and spaces with no visible growth. However, in several instances no amplification was seen in airborne concentrations when large areas of fungal growth were present, and high amplification was seen in several areas where there was no visible fungal growth.

It is concluded that airborne fungal spore sampling is inadequate to completely characterize necessary remedial action items required for fungal contamination in occupied spaces. Relying solely on airborne fungal spore samples could lead to inactivity in occupied spaces requiring remediation of fungal growth.

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ENDOTOXIN AND 3-HYDROXY FATTY ACID ANALYSIS OF AIR AND DUST SAMPLES FROM AN OFFICE BUILDING. C.J. Hines, M. Petersen, M. Mendell, NIOSH, Cincinnati, OH; D. Milton, Harvard School of Public Health, Boston, MA; L. Larsson, University of Lund, Lund, Sweden; W. Fisk, Lawrence Berkeley National Laboratory, Berkeley, CA

Air and dust samples for endotoxin were collected on two floors of an office building during a double-blind particle intervention study. Sampling was performed to examine spatial and temporal variability of endotoxin in air over a period of weeks and to characterize endotoxin potency and lipopolysaccharide (LPS) content in carpet and chair dust. Each floor was divided into four subspaces. Air samples were collected on 0.4-mm polycarbonate filters at 3 L/min for 8 hours within and across weeks, with two measurements per subspace. Dust samples were collected from carpets and chairs 1 day per week for 3 weeks on glass-fiber filters. All samples were analyzed for endotoxin with the Limulus assay. Dust samples were analyzed for LPS content by determination of 3-hydroxy fatty acids using GC-MS.

The GM (GSD) for indoor air samples was 0.29 EU/m^3, (1.6, n=96). The effect of subspace on the log of endotoxin air concentrations was highly significant ($p<0.005$, n=80). No effect of week, floor, or replicate was found. Mean endotoxin levels in carpet dust (59 EU/mg, n=12) and chair dust (38 EU/mg, n=10) were significantly different ($p<0.001$). Mean LPS for all dust samples was 72 ± 9.6 pmoles/mg (n=22). Effects of dust source and floor on LPS levels depended on chain length. Carpet dust contained larger amounts of C_{10} and C_{12} LPS than chair dust ($p<0.05$, and <0.01, respectively); however, the amount of C_{16} LPS in chair dust was greater than in carpet dust ($p<0.01$). C_{16} LPS amounts were significantly different between the two floors ($p<0.05$). Endotoxin potency was correlated positively with C_{12} (r= -0.612) and negatively with C_{16} (r=0.673) LPS. These results indicate that location within floor was an important determinant of endotoxin exposure and that chemical analysis is useful for exploring microbial-related differences in dust composition.

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OCHRATOXIN A PRODUCTION BY *ASPERGILLUS OCHRACEUS* GROWING ON CEILING TILE AND CARPET. R.R. Salazar, P. Sherblom, Y. Hammad, University of South Florida, Tampa, FL

Production of mycotoxins by fungal organisms growing on food and feed products has been well documented. Morbidity and mortality among humans and animals from ingestion of contaminated products is known. Production of mycotoxins by toxigenic fungi growing on indoor environmental substrates, however, remains poorly understood. Except for a few select organisms, studies evaluating toxin production by numerous other toxigenic fungi commonly found growing on indoor substrates is lacking. This study evaluated production of ochratoxin A by *Aspergillus ochraceus* growing on ceiling tile, carpet, and liquid media.

Spore suspensions of *A. ochraceus* were inoculated onto ceiling tile and carpet at controlled water saturation and relative humidity levels. Inoculated liquid media served as experimental controls. Spore germination on experimental substrates was determined microscopically. Chamber air and substrate vacuum samples were collected onto Teflon7 membrane filters and analyzed for ochratoxin A by reversed-phase high-performance liquid chromatography with ultraviolet absorbance detection.

Except for ceiling tile samples under unsaturated conditions, spore germination was noted on all experimental substrates. Mycotoxin was not detected in spores or mycelial fragments collected by air and vacuum sampling of experimental substrates and liquid media. Mycotoxin was detected in the liquid portion of liquid media.

The results suggest experimental carpet substrates are more conducive to proliferation of *A. ochraceus* than ceiling tile substrates. Moisture availability appears conducive to fungal growth. Detection of mycotoxin in only the liquid portion of liquid media suggests characteristic production of ochratoxin A by *A. ochraceus* may be restricted to its growth substrate.

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INTERNATIONAL INTERLABORATORY COMPARISON OF ENDOTOXIN ASSAYS USING AGRICULTURAL DUSTS. S.J. Reynolds, P. Thorne, K. Donham, E. Croteau, K. Kelly, University of Iowa, Iowa City, IA; D. Milton, Harvard School of Public Health. Boston, MA; D. Lewis, NIOSH, Morgantown, WV; D. Heederick, Wageningen Agricultural University, Wageningen, The Netherlands; I. Connaughton, Bendigo Agricultural Centre, Victoria, Australia; B. Larsson, P. Malmberg, National Institute for Working Life, Solna, Sweden

Endotoxin from gram-negative bacteria pose a significant respiratory hazard. Establishing dose-response relationships is problematic since there are no standard procedures for sampling and analysis. The goal of this study was to evaluate the performance of six laboratories using Limulus-based assays for analysis for organic dusts from three agricultural environments.

Dusts from chicken and swine barns and a corn processing facility were used to generate homogeneous aerosols in the laboratory. Fourteen side-by-side air samples were collected on 37 mm glass-fiber filters at flows of 2 L/min. Each laboratory was randomly allocated 14 filters per dust type. Three laboratories used the QCL-1000 Endpoint Assay, and three used the Kinetic-QCL method. To eliminate variability among different lots, a single lot of LAL for Endpoint Assays, and one similar lot for Kinetic Assays were provided. There were significant differences between laboratories for all three dust types ($p<0.01$). The pattern of differences between labs varied by dust type. For chicken dust, labs using the Endpoint method reported higher results than those using Kinetic methods. For swine and corn dusts the labs using the Kinetic method reported the highest endotoxin values. For chicken dust, results from all six labs were highly correlated (r=0.85 to 0.99). For swine dust one lab (E) was not correlated, but the others were again highly correlated. For corn dust four of the labs were significantly correlated. Most labs were within one standard deviation of the mean result for individual experiments. All labs were well within two standard deviations of the mean result for individual experiments. In conclusion, statistical differences in performance between laboratories were apparent and may be related to the extraction and analytical methods. The results of this study will be used to help develop a standardized sampling/analytical method for airborne endotoxin in agriculture.

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