Aerodynamic characteristics and respiratory deposition of fungal fragments

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Résumé / Abstract

The purpose of this study was to investigate the aerodynamic characteristics of fungal fragments and to estimate their respiratory deposition. Fragments and spores of three different fungal species (Aspergillus versicolor, Penicillium melinii, and Stachybotrys chartarum) were aerosolizcd by the fungal spore source strength tester (FSSST). An electrical low-pressure impactor (ELP1) measured the size distribution in real-time and collected the aerosolized fungal particles simultaneously onto 12 impactor stages in the size range of 0.3-10um utilizing water-soluble ZEF-X10 coating of the impaction stages to prevent spore bounce. For S. chartarum, the average concentration of released fungal fragments was 380 particles cm^{-3}, which was about 514 times higher than that of spores. A. versicolor was found to release comparable amount of spores and fragments. Microscopic analysis confirmed that S. chartarum and A. versicolor did not show any significant spore bounce, whereas the size distribution of P. melinii fragments was masked by spore bounce. Respiratory deposition was calculated using a computer-based model, LUDEP 2.07, for an adult male and a 3-month-old infant utilizing the database on the concentration and size distribution of S. churtarwn and A. versicolor aerosols measured by the ELPI. Total deposition fractions for fragments and spores were 27-46% and 84-95%, respectively, showing slightly higher values in an infant than in an adult. For S. chartarum, fragments demonstrated 230-250 fold higher respiratory deposition than spores, while the number of deposited fragments and spores of A. versicolor were comparable. It was revealed that the deposition ratio (the number of deposited fragments divided by that of deposited spores) in the lower airways for an infant was 4-5 times higher than that for an adult. As fungal fragments have been shown to contain mycotoxins and antigens, further exposure assessment should include the measurement of fungal fragments for evaluating mold exposures in damp buildings.

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