The bactericidal effects of negative ions in air

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Introduction

The use of negative ions to improve indoor air quality has attracted increasing attention in recent years. Although the physical action of air ionisers is accepted, there is still debate over their apparent biocidal action. A recent clinical trial in an intensive care unit suggested that air ionisers may have a role in reducing the transmission of infection in healthcare environments[1] and several authors have reported that ions inhibit the growth of a range of microorganisms. A further understanding of this process was gained through bench scale experiments exposing sessile cultures to positive and negative ions[2]. The aim of the work presented here was to follow on from the bench scale experiments to investigate the efficacy of negative ions with aerosolised microorganisms.

Methods

Experiments were carried out in a mechanically ventilated 32m^3 bioaerosol chamber under controlled environmental conditions. A pure culture of the test organism was nebulised into the chamber. Under steady state conditions replicate air samples were taken using a six stage Andersen sampler. The negative ioniser was then switched on and after 30 minutes a further set of replicate samples were taken. The mean was taken of the replicate samples to give a mean concentration with and without ions. The mean reduction in concentration was calculated to give an indication of the efficacy of the ions. In order to determine the statistical significance of the results a t-test was carried out on the two data sets.

Results

Figure 1 shows the results from three of the experiments carried out using pure cultures of *M. parafortuitum*, *S. aureus* and *A. fumigatus*. It can be seen here that the efficacy of the negative ions is dependent upon the species being used. Tests against bioaerosols of *S. aureus*, *M. parafortuitum* and *S. marcescens* showed no significant difference in the airborne concentration with and without ions ($p>0.05$). In contrast tests using *B. subtilis* spores, *A. fumigatus* spores and *P. aeruginosa* showed reductions of 42.7%, 38.6% and 72.6% respectively with results significant at the 95% confidence limit.

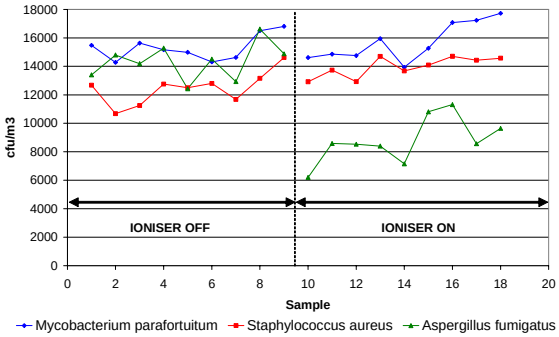

Figure 1. Effect of negative ions on aerosolised microorganisms.

Conclusions

The findings show that survival in the presence of negative ions varies considerably between the different species, suggesting that in a hospital environment ionisers may be more effective against some infections than others

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2. Fletcher LA, Gaunt LF, Beggs CB et al. Bactericidal action of positive and negative ions in air. BMC Microbiology. 7; 32; (2007).