

# Evaluation of the performance of the Ambion Ioniser



## Objectives of the study

The aim of the test was to determine the performance of the Ambion Ioniser in terms of the ability to reduce the concentration of test microorganisms in the air in the test chamber under controlled environmental conditions. The test chamber was operated at ambient temperature and relative humidity at ~1.5 AC/hr.

## Devices Location

The device was located in position e shown in Figure 1, below.

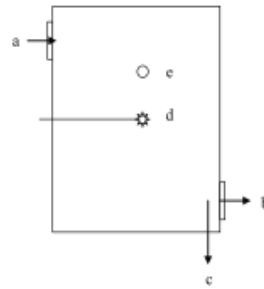


Figure 1: The experimental layout of the test chamber

(a, air inlet; b, air outlet; c, sampling point; d, the point at which the bacterial/fungal aerosol is introduced, e, the location of the devices)

## The Test Microorganism

The experiments were performed using bioaerosols of *Staphylococcus aureus* (ATCC 13709) which is a gram positive bacterium and is a major cause of hospital acquired infections. Hospital strains are usually resistant to a variety of antibiotics (e.g. MRSA) and many are resistant to antiseptics and disinfectants which aids its survival in the hospital environment.

## Experimental Methodology

The experiments were carried out in the aerobiological test chamber at the University of Leeds (see Figure 1), which consists of a 32.25m<sup>3</sup> hermetically sealed negatively pressurised room in which the air flow rate, temperature and relative humidity can be constantly controlled and monitored. The experiments were carried out with the ventilation system set at 1.5 AC/hr at ambient temperature (approx 20°C) and relative humidity (approx 50%).

The test room was set up as shown in Figure 1 prior to the start of each experiment and the chamber door closed and locked and both the sampling port (c) and the nebuliser port (d) sealed. The air fans were then switched on and operated at maximum speed (approx 12AC/hr) for 30 minutes in order to ensure the chamber was sterile.

After the initial purging period the ventilation rate was reduced to 1.5 AC/hr and nebulisation of the bacterial culture then began and the concentration in the test chamber was allowed to stabilize for 30 minutes. A total of ten samples were then taken during which time the ionizer device remained switched off and these are the control samples. Once all ten samples had been taken the ionizer device was then switched on remotely and left for 30 minutes for the concentration of bacteria in the air inside the chamber to reach steady state once again. A further ten replicate samples were then taken as described above.

The agar plates were incubated at 37°C for 24 hours after which the number of colonies on each plate were counted. All the counts were then subjected to positive hole correction in order to account for multiple impaction (Macher 1989).

The corrected counts for each set of plates (stages 5 and 6) were added together to give a total count and multiplied to give a count per m<sup>3</sup> of test chamber air. Each set of samples represents ten replicates taken during steady state, the first ten being the concentration without the device operating and the second ten with the device switched on. The mean was taken of the ten replicate samples to give a mean concentration with and without the device. This allowed the mean reduction in concentration to be calculated used to give an indication as to the efficacy of the device

In order to determine the statistical significance of the results a t-test was carried out on the two data sets (before and after). The purpose of the test is to determine whether the means of the two data sets are statistically different from each other. The test yields a p-value and the smaller the p-value the less likely the difference between the two data sets is the result of chance.

### Performance of the Ambion ionizer device

Figure 2 shows the concentration of airborne *S. aureus* and it clear that there was a dramatic drop in the concentration when the ioniser device was switched on. The concentration during the control period ranged from 32541 to 72982 cfu/m<sup>3</sup> with an average concentration of 48943 cfu/m<sup>3</sup>. When the ioniser device was in operation the concentration ranged from 71 to 322 cfu/m<sup>3</sup> with an average concentration of 138 cfu/m<sup>3</sup> which represents a kill of 99.7%

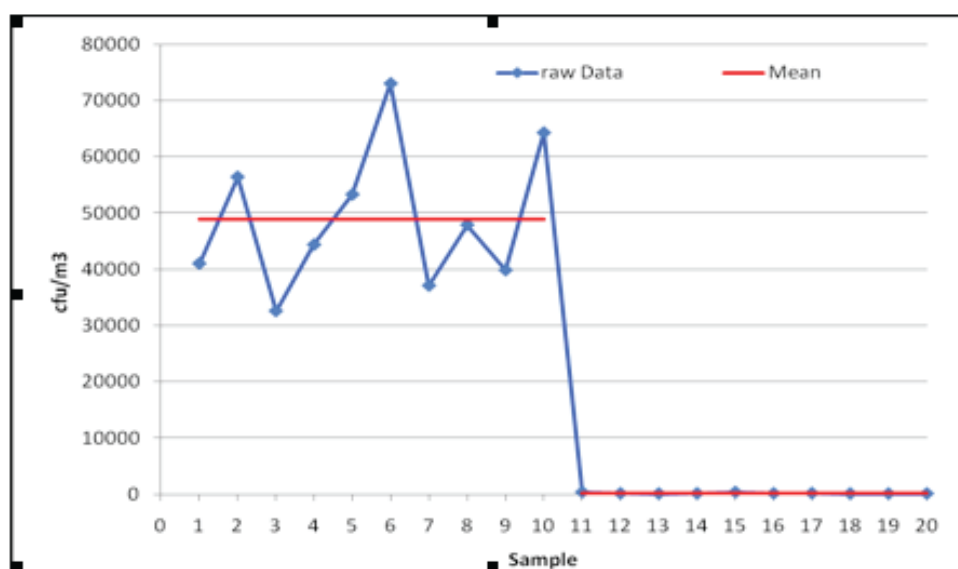


Figure 2 Effect of the Ambion ionizer device on the concentration of airborne *S. aureus*

### Conclusion

- The Ambion ioniser is capable of significantly reducing the concentration of airborne *S. aureus* in the test chamber
- When the Ambion ioniser device was in operation the concentration of airborne *S. aureus* dropped from an average of 48,943 cfu/m<sup>3</sup> to 138 cfu/m<sup>3</sup> which represents a kill of 99.7%.
- A t-test carried out showed the difference between the two data sets to be highly significant ( $P < 0.01$ ).