Microbiological Report

Antimicrobial Performance of the Medixair UVc Air Sterilisation Device in the Sterilisation of Three Strains of Staphylococcus

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1.0 INTRODUCTION

My name is R.D.O'Connor, I hold B.Sc.(Hons) degree in applied environmental microbiology and I am a chartered Biologist (Ci.Biol). I currently work as a practising microbiologist and C.E.O. of a UKAS accredited, DEFRA (formerly MAFF) authorised contract laboratory, capable of handling up to Class II pathogens.

1.1 FINDINGS

This document presents the findings from a study of the Medixair UVc air sterilisation unit. In relation to three strains of Staphylococcus aureus which are off considerable medical significance. The Medixair unit is a multi lamp UVc emitter which passes air through a decontamination chamber by means of a fan and which is intended for use in atmospheric control of Biohazards.

The following organisms were employed in the trial ;

Staphylococcus aureus; NCTC 11939; Carries gentamicin and Chloramphenicol plasmids/Epidemic methicillin resistant strain

Staphylococcus aureus; NCTC 11940 ; Epidemic methicillin resistant strain

Staphylococcus aureus; NCTC 11962 ; Associated with post operative toxic shock

2.0 THE *IN VITRO* PERFORMANCE TRIALS OF A MEDIXAIR LAMP

2.1 Conditions;

In this section of work our goal was to establish that a single lamp, of the type employed in the construction of the Medixair unit, was capable of producing satisfactory levels of lethality with the nominated strains Staphylococcus aureus.

These trials were conducted by inoculating the surface of Tryptone Soya Agar plates with aliquots of mid exponential cell cultures.

All inoculated plates were conditioned at 30'C for 2 hours prior to UVc treatment.

The lamp employed in the trial was mounted in a bespoke chamber, which facilitated the positioning of an exposed agar plate in a manner such that the surface of the plate was 50mm from the UVc source. Prior to initial use the lamp was pre-conditioned. Prior to plate exposure the lamp was stabilised for 30 minutes. Applicable safety procedures were in force during this and all other experiments.

Exposure of inoculated plates occurred over successive 15 second increments up to and including the 60 second mark.. Cell density was estimated by deployment of sterile bores capable of obtaining 5 cm^2 sections of agar to a depth of 5 mm. The resulting core was subject to serial dilution with subsequent recovery of isolates on appropriate agars. All analyses were conducted in duplicate.

3.0 ATMOSPHERIC VOLUMETRIC ANTIMICROBIAL PERFORMANCE OF THE MEDIXAIR DEVICE.

These trials were conducted in a microbiologically sealed PVA construction consisting of a chamber with an operating volume of 54 $m^{3.}$. Four floor-mounted fans were employed to assist with microbial dispersion and also a silica gel unit to prevent excessive humidity build up. All surfaces (excluding the internal surfaces of the Medixair unit) were sprayed with an anti static treatment. Pressure equalisation occurred via four apertures secured by 0.2-micron membrane filters.

This facility was equipped both for the introduction of microbial aerosols and for volumetric recovery of atmosphere in volumes of an appropriate diluent medium.

All test organisms were obtained as calibrated mid exponential cultures.

Prior to introduction of the test organisms the lamp complex was run in circuit for 4 hours to eliminate airborne contamination resident within the system. Control plates showed that all occasions this conditioning sterilisation action did reduce internal contamination to <10 cfu/m^3.

All studies were conducted over 8 hours and each study was repeated twice times over consecutive days.

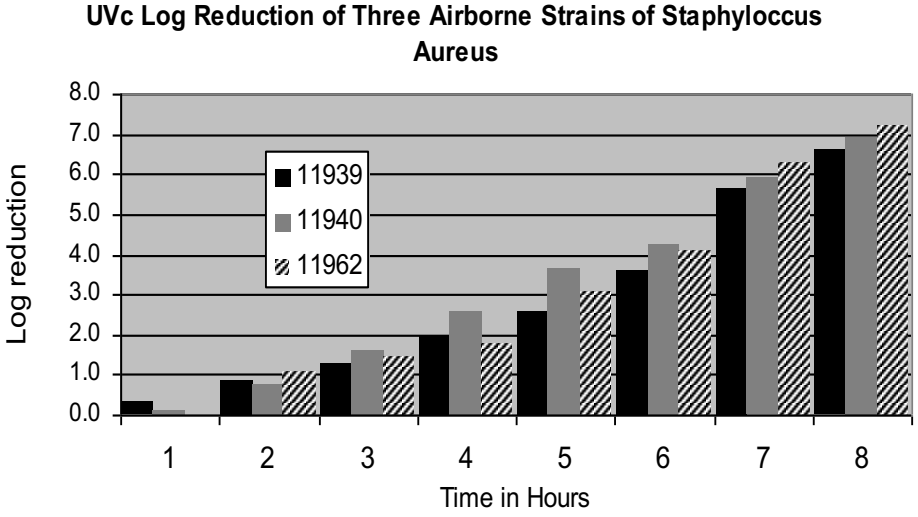
Sampling was achieved by aspiration of a 1 m^3 atmosphere volume through 100 ml of diluent (Peptone Saline recovery Broth) which formed the initial test dilution. Recovery of isolates was obtained by serial dilution and plating on appropriate agars. All analyses were conducted in duplicate with appropriate controls.

4.0 EXPERIMENTAL RESULTS

Table 1: Percentage kill *(in vitro)* verses exposure to UVc with three strains of Staphylococcus aureus

			Exposure time cfu/cm2 agar/recovered				% Reduction
		T= sec	T= sec	T= sec	T= sec	T= sec	
S.aureus	N	0	15	30	45	60	
11939	4	9.30E+07	5.20E+05	1300	4	0	>99.999
11940	4	4.60E+07	6.10E+05	2400	9	0	>99.999
11962	4	1.90E+07	8.30E+04	670	3	0	>99.999

Sample point in hours	UVc cfu/ m3 recovered	UVc Log Kill	UVc cfu/ m3 recovered	UVc Log Kill	UVc cfu/ m3 recovered	UVc Log Kill
	11939	11939	11940	11940	11962	11962
0	3.30E+08	0.0	4.20E+08	0.0	6.10E+08	0.0
1	1.60E+08	0.3	2.70E+08	0.1	3.40E+08	0.0
2	4.50E+07	0.9	6.20E+07	0.7	2.70E+07	1.1
3	1.60E+07	1.3	8.40E+06	1.6	1.20E+07	1.4
4	3.20E+06	2.0	9.20E+05	2.6	5.30E+06	1.8
5	9.20E+05	2.6	7.30E+04	3.7	3.00E+05	3.0
6	8.60E+04	3.6	2.00E+04	4.2	2.80E+04	4.1
7	7.40E+02	5.6	3.90E+02	5.9	1.70E+02	6.3
8	8.00E+01	6.6	4.00E+01	6.9	2.00E+01	7.2



5.0 DISCUSSION

The three strains of Staphylococcus aureus employed in this study currently represent serious environmental challenges in the medical domain. Eradicating or efficiently controlling the incidence of these strains from all categories of medical environment requires a multi-faceted approach. In this trial we have demonstrated that treatments with UVc doses is capable of bringing about a greater than 99.999 % reduction of Staphylococcal numbers within one minute. On this point it should borne in mind that this was achieved with numbers of organisms far in excess of those which would normally be present in a high care medical environment.

We have further demonstrated that the Medixair device is capable of achieving between 6.6 and 7.2 log cycles of kill over an eight-hour period. Again, this was demonstrated by employing very high numbers of organisms in atmospheric dispersion and such a performance therefore represents a very positive indicator that the device presents as a valuable utility in any strategy designed to control Staphylococcal contamination of medical environments.

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