

A Novel Device for the Prevention of Airborne Infections

We report a novel UV radiation decontamination device, used for preventing airborne infections with *Pseudomonas aeruginosa* and *Mycobacterium tuberculosis hominis*, both highly resistant to UV radiation.

We used a Sterilite (AB medica-Italy; U.S. patent 5.112.370, EEC patent 461310) device which conveys contaminated air through an optical labyrinth into the germicide radiation area. Passing through another optical labyrinth, the air is released

into the room. The optical labyrinth completely traps germicide radiation, so that high radiation levels may be used continuously (Fig. 1). The Sterilite equipment was positioned inside a closed laminar flow hood (0.5 m³). Five milliliters of a *Pseudomonas* culture (15 × 10⁸ CFU/ml) was aerosolized inside the hood for 5 min. The aspiration system of the device was then switched on without activating the UV lamps. Six MacConkey petri plates were positioned in the hood at the release end of the equipment and sequentially exposed for 60 s each (minutes 0 to 6). After decontamination of the hood, the same experiment was conducted with both the aspiration system and the UV lamps activated. All plates were incubated at 37°C for 24 h prior to determination of colony numbers. Tests were run in triplicate.

The study was repeated by using a *Mycobacterium* culture (7.5 × 10⁷ CFU/ml) aerosol inside the hood with Middlebrook 7H11 agar plates. All plates were incubated at 37°C for 60 days prior to determination of colony numbers. To avoid bacterial contamination of *Mycobacterium* culture plates, the hood was pretreated for 30 min with the Sterilite device with UV lamps activated.

When the UV lamps were inactive, *Pseudomonas* was detected at high colony counts (mean number of colonies, 71 ± 25) on all plates throughout the period of exposure. Similarly, high *M. tuberculosis* colony counts were obtained during the entire 6-min period of exposure on all tested plates (mean numbers of colonies, 61 ± 6.36).

When UV lamps were switched on, *Pseudomonas* colony counts immediately dropped significantly (to 5 ± 2), and negative cultures were obtained between 2 and 3 min following UV activation. Conversely, after activation of the UV lamps in the presence of *M. tuberculosis* cultures there was a steady gradual drop in the number of colonies over time and only at minute 6 were negative cultures obtained in all the experiments performed (Table 1).

The Sterilite device, which presents all the advantages of the high germicidal efficacy of UV radiation without any of the

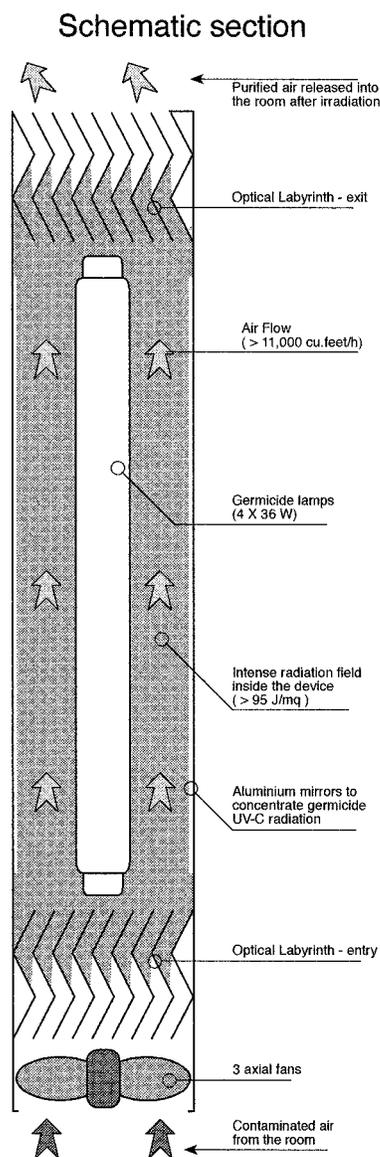


FIG. 1. Schematic section of Sterilite device. Optical labyrinths keep UV-C radiation strictly confined inside the device with low air flow resistance, allowing a high-intensity UV-C field with absolute safety for people present. Irradiation takes place in direct contact with the lamps (wavelength, 253.7 nm), where it is at its maximum efficacy and is concentrated with special aluminum mirrors.

TABLE 1. Comparison of the variations in *Mycobacterium* colony counts over time with UV lamps switched off and UV lamps switched on

Time of sequential exposure (min)	Value (no. of colonies ± SD) ^a		P value (t test for unpaired data)
	UV lamps off	UV lamps on	
0–1	67.6 ± 14.6	71.3 ± 9.6	NS ^c
1–2	63.3 ± 12.8	56.6 ± 8 ^b	NS
2–3	66 ± 16	40 ± 9.1 ^b	<0.02
3–4	56.5 ± 10.4	12.3 ± 8.5 ^b	<0.001
4–5	50.3 ± 11.7	0.66 ± 1.15 ^b	<0.001
5–6	62.3 ± 11.6		<0.001

^a Mean value obtained from three experiments.

^b Difference statistically significant ($P < 0.05$ as determined by t test for unpaired data) compared to value for minute 1.

^c NS, not significant.

known side effects, appears to be highly effective and may represent a unique tool for preventing airborne infections.

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Ed. Note: Michele Gazzano is named on the U.S. and European Sterilite system patents. No other participant in this study has a financial or consultative relationship with AB medica-Italy, the manufacturer of the Sterilite system.