Safety of portable inoculation cabinets

STUART J. LINE From the Department of Microbiology, Northwick Park Hospital, Harrow

Laboratory work with pathogenic microorganisms should be performed in a ventilated safety cabinet. A minimum airflow of 0.5 metres per second through the working aperture has been recommended, with discharge of the exhaust air through a filter, then into the open air (Department of Health and Social Security, 1970). Such a unit must be permanently installed.

There are possible advantages to a portable unit, in which the filter is replaced by a ‘furnace’, the sterile exhaust then being discharged into the laboratory (Brown, 1961). The performance of a commercially available cabinet of this type is reported here.

Materials and Methods

THE CABINET
The sheet-steel cabinet is 86 cm wide, 38 cm deep, and 57 cm high, with a sloping glass front; the working aperture is 84 x 13 cm. Air is drawn through the aperture and over an electrically heated 750 W element on top of the cabinet before being blown into the laboratory by an axial-flow fan. The fan and heater are wired to operate together. After use the airflow system is switched off and a 15 W ultraviolet lamp is turned on for a recommended period of 30 minutes, with the object of disinfecting the interior of the cabinet.

The makers state that the airflow is 20 ft² per minute (0.01 m³ sec) giving five cabinet airchanges per minute, with the air temperature reaching 400°C during incineration.

AIR VELOCITIES
Airflow through the working aperture was measured with a Casella Sensitive Air Meter.

TEST ORGANISM
Streptococcus hominis (salivarius) was grown overnight in 15 ml of 0.1% glucose broth; the concentration of viable organisms was 6 x 10⁶ per ml. Immediately before use the broth culture was diluted with an equal volume of quarter-strength Ringer’s solution and transferred to a simple plastic spray bottle.

CULTURE MEDIUM
The medium for air sampling was 5% sucrose agar (Cowan and Steel, 1965) in 9 cm petri dishes. On this medium Str. salivarius forms easily recognized mucoid colonies (Williams, 1956).

TEST PROCEDURE
The fan and incinerator were switched on for a 30-minute warm-up period, as recommended by the makers.

Str. hominis was then sprayed inside the cabinet, by squeezing the spray bottle once every five seconds during a five-minute test period. This procedure consumed 12 ml of diluted bacterial suspension, thus discharging about 4 x 10⁶ organisms.

The fan and heater were then turned off and the ultraviolet lamp was switched on for a 30-minute sterilization period.

The furnace efficiency was assessed by holding a sucrose-agar plate 10 cm from the air-discharge aperture before, during, and after the organism suspension was sprayed (plates 1-4 exposed consecutively).

Effectiveness of the ultraviolet lamp for sterilizing the interior of the cabinet was assessed by exposing two sucrose-agar plates inside the cabinet; one was in the cabinet during the test period only (plate 5), the other was in the cabinet during the test and sterilization periods (plate 6).

After overnight incubation of the plates at 37°C the colonies of Str. hominis were counted.
Results and Discussion

Air-flow measurements at the working aperture showed an air speed of 0.137 m/second. After panels had been fitted to reduce the aperture from 84 x 13 cm to the minimum practicable size of 31 x 13 cm, the flow was increased to 0.32 m/second—still less than the recommended rate of 0.5 m/second.

Tests of the furnace efficiency (Table, plates 1-4) showed that viable Str. hominis survived in the effluent air and were discharged into the laboratory. Calculations show that to heat the exhaust air from 20°C to the claimed 400°C would need a 4,300 W heater, instead of the 750 W unit provided. This would be equivalent to running at least a four-bar electric fire in the laboratory!

<table>
<thead>
<tr>
<th>Plate No.</th>
<th>Site and Duration of Exposure</th>
<th>No. of Colonies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>At exhaust, 3 minutes before test period</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>At exhaust, 1 minute during</td>
<td>105</td>
</tr>
<tr>
<td>3</td>
<td>At exhaust, 3 minutes during</td>
<td>293</td>
</tr>
<tr>
<td>4</td>
<td>At exhaust, 3 minutes after</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Inside cabinet throughout test period</td>
<td>Confluent growth</td>
</tr>
<tr>
<td>6</td>
<td>Inside cabinet throughout test and</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>sterilization periods</td>
<td></td>
</tr>
</tbody>
</table>

Table: Number of colonies of Str. hominis on sucrose-agar sampling plates

Survival of the test organisms on plate 6 indicated failure of 30-minute ultraviolet irradiation to sterilize exposed surfaces in the cabinet. Organisms on surfaces shadowed from the lamp showed a proportionately greater survival.

I do not suggest that all furnace-type cabinets would perform as badly as this one, nor do I suggest how this particular model could be improved. These findings are reported to indicate the need for testing equipment of this kind before accepting it as part of the safety arrangements in a laboratory.

I would like to thank Dr R. Blowers, Miss L. Owens, Miss B. Pentland, Mrs M. Wood, and Mr E. Wallington for their help.

References


Use of ultraviolet light in the typing of Pseudomonas aeruginosa strains by pyocin production

L. Lovrekovich, H. Lovrekovich, and D. C. Jenkins
From the Clinical Laboratories, Department of Pathology, University of Kansas Medical Center, Kansas City, Kansas, USA.

Pseudomonas aeruginosa isolates can be successfully identified by their pyocin production (Darrel and Wahba, 1964; Gillies and Govan, 1966). This warranted the introduction of pyocin typing into our laboratory as a method for studying the epidemiology of *P. aeruginosa* infections. In the course of this study it was found that the method generally used for typing bacteria by pyocin production could be improved. Since we obtained good results with this improved technique it seemed justified to describe the modification in this paper.

Materials and Methods

The typing of the *P. aeruginosa* isolates was carried out by the modified method of Abbott and Shannon (1958) and Gillies (1964) in the following way.

The strain to be typed, the so-called producer, was streaked in a single line on a Mueller-Hinton1 agar plate in a Petri dish. After incubation for 18 hours, at 37°C, the bulk of the bacteria was removed from the agar with a glass slide. The bacteria which remained on the surface of the medium were first evenly spread with a moist swab, and subsequently killed by exposing the surface of the agar to ultraviolet light. Under our conditions, sterilization was effective after exposing the uncovered plates to irradiation for five minutes at a distance of 40 cm from the germicide lamp. After sterilization six strains, so-called indicators, were tested for their sensitivity to the produced pyocin. These strains were grown for four hours, at 37°C, in a trypticase soy broth before they were streaked at right angles to the first line of inoculation on the agar plate. After incubation for 18 hours, at 37°C, the inhibition of the indicator strains at the site of the accumulated pyocin was observed.

Results

The modification of the typing method consists of

1Baltimore Biological Laboratory, Cockeysville, Maryland, U.S.A.

Received for publication 29 April 1971.