comparisons, 3.87 to 29.3 times as many bacteria were detected by the direct plating procedure as by swab tests.

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A Slit Sampler for Collecting Air-Borne Microorganisms

HERBERT M. DECKER AND MYRL E. WILSON[1]

Chemical Corps Biological Laboratories, Camp Detrick, Frederick, Maryland

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There is an increasing need by civilian defense agencies, research laboratories, and hospitals, for an inexpensive, simple, continuous sampling device that will recover air-borne microorganisms. Such a device should sample a relatively large quantity of air, should permit direct impingement of the organisms on the growth media, and should be easy to use in the field or laboratory.

Bourdillion, Lidwell and Schuster (1948) have developed several slit samplers. These have been complex mechanical units, difficult to sterilize, delicate, and requiring specially designed agar collection plates.

Luckiesh, Holiday and Taylor (1946) have developed a portable air sampler; however the collection surface is limited to a standard (100 x 15 mm) Petri dish and there is no means of determining the period in which the maximum biological concentration is collected. Furthermore, the sampling time is limited with the Petri dish as desiccation of the media occurs if exposed to prolonged periods of air sampling.

MATERIALS AND METHODS

An inexpensive slit sampler for collecting microorganisms has been designed which utilizes a 150 x 20 mm culture plate possessing 2.2 times the area of the standard Petri dish. This increased area permits collection of a much greater number of organisms with this type of sampler and prevents drying out of the media. A simple timing device is incorporated in the design of the sampler which permits rotation at the rate of 1 revolution per hour, and renders an accurate time concentration relationship.

The modified slit sampler and its component parts are shown in figures 1 through 4. The sampler is composed of 1) a slit and slit tube, 2) sampling box, 3) agar culture plate (150 x 20 mm), 4) agar plate holder, 5) drive shaft, 6) 1-hour interval timer, and 7) interval

FIG. 1. General view, modified slit sampler

[1] Second Lieutenant, USAF (MSC).

FIG. 2. Modified slit sampler with 150 x 20-mm agar culture plate in position.

timer housing. The slit and slit tube is threaded into the sampling box, and may be easily adjusted to the proper level as determined by the height indicator. The height indicator is a metal shaft with small discs at each end to show the level of the agar in the collection plate. The slit opening may be set at various widths, by means of two recessed screws which hold the two metal plates on the slit tube in place. The sampling box is a cylindrical container housing the culture dish and the agar plate holder. The dish containing the impingement media is commercially available. The agar plate holder is a metallic platform containing four clips which hold the plate securely in position. The drive shaft is ball bearing suspended and is mounted to the interval timer by means of an adapter. The function of the interval timer is to provide uniform rotation of the plate for a period of 1 hour. The housing for the interval timer is made gas-tight by means of an "O" ring placed in a groove on the bottom exterior

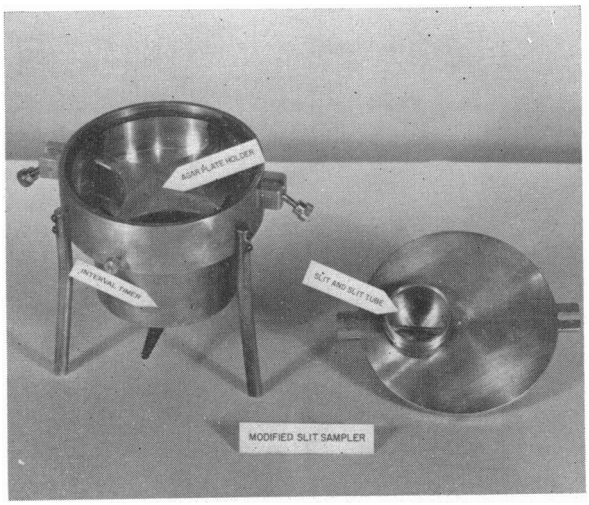

FIG. 3. Modified slit sampler showing assembly of agar plate holder.

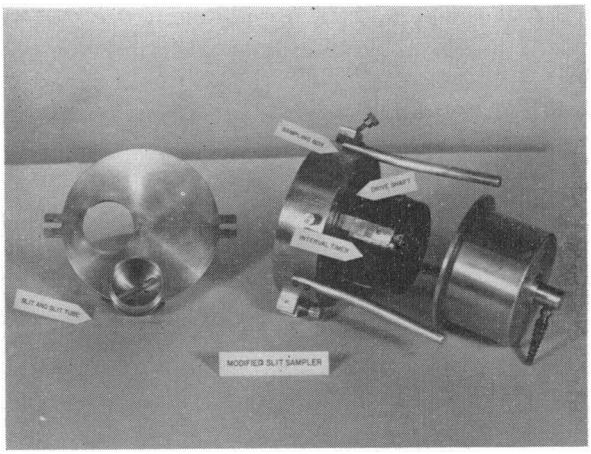

FIG. 4. Component parts of modified slit sampler

surface of the sampling box. When the interval timer housing is screwed in position a gas-tight seal is secured. The volume and rate of air flow are determined by a calibrated flowmeter.

EXPERIMENTAL RESULTS

A suspension of *Serratia indica* was atomized by means of an all-glass direct-spray peripheral air jet Chicago-type atomizer (Rosebury, 1948) into a room 12′ x 10′ x 9′ in size. Two sieve-type air samplers (DuBuy *et al.*, 1945) and the slit sampler were placed on the bench top in the nebulization room. Air samples were taken from the same height and location. The results of six tests, each constituting the average of 30

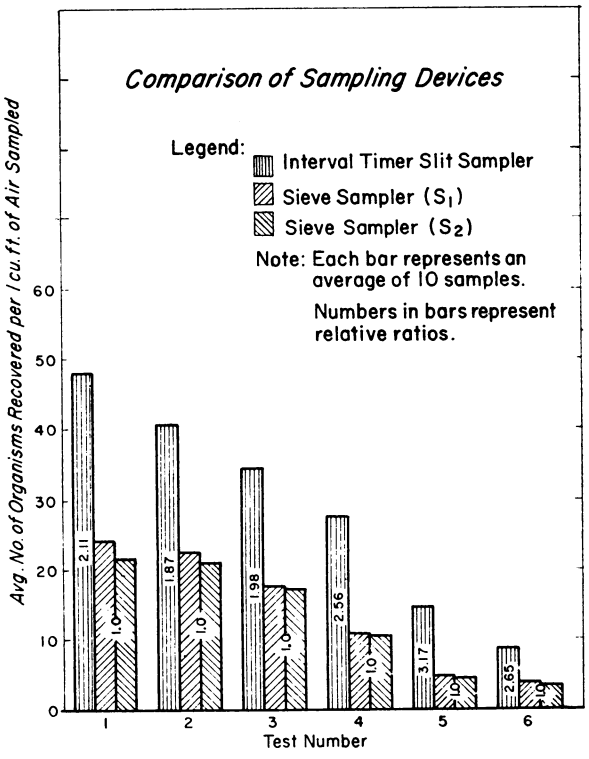

FIG. 5

different samples, (10 samples per bar) are shown in graphic form in figure 5. The efficiency of the slit sampler was obtained by considering the average number of organisms collected per cubic foot of air sampled with the sieve samplers as unity and comparing this number against those collected with the slit sampler. The average of these ratios shows that the slit sampler evaluated is 2.4 times as efficient as the sieve-type sampler. To substantiate these results, another laboratory experienced in sampler evaluation compared the sieve and slit sampler described above, and reported this slit sampler to be 2.5 times as efficient as the sieve sampler.

Summary

A portable rotating air sampling device has been developed that will sample and directly impinge air on a 20 x 150 mm agar plate. This sampler has been found to be 2.4 as efficient as the sieve sampler and has the advantage of sampling air at the rate of 1 cubic foot per minute for as long as 60 minutes, whereas the sieve sampler is limited to a maximum use of 10 minutes, since pitting and drying of the media will occur. Concentrations of 2500 colonies per hour can be individually counted without difficulty in contrast to a maximum 340 colonies on the sieve sampler plate. Civilian defense agencies, hospitals, and research institutions can utilize this sampler for detection of microorganisms in the atmosphere. Air-borne transmission of disease should be traced more readily by use of this simple sampler.

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The Effects of Ultraviolet Irradiation on Large Populations of Certain Water-Borne Bacteria in Motion

II. Some Physical Factors Affecting the Effectiveness of Germicidal Ultraviolet Irradiation

J. R. Cortelyou, M. A. McWhinnie, M. S. Riddiford[1], and J. E. Semrad

De Paul University, Chicago, Illinois

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In a previous paper, (Cortelyou *et al.*, 1954) reference was made to the necessity of investigating some of the physical factors which can affect the efficiency of ultraviolet irradiation of certain bacteria in water.

One of these factors is the intensity of the ultraviolet light which is available for germicidal action. Decrease in intensity will occur as a function of burning hours of lamp, voltage, absorption, and temperature.

This paper is concerned chiefly with the findings of the germicidal efficiency of the G.E. G4T4/1 lamp when employed in the unit previously described (Cortelyou *et al.*, 1954), the intensities of the lamp being varied across a wide range.

Materials and Methods

The apparatus used in this work was substantially the same as reported in the previous paper mentioned above. *Escherichia coli*, the representative coliform organism, was used in this series of experiments. Large volumes of water were inoculated with 12- to 24-hour broth suspensions of this species. Final contaminations ranged from 43,000 to 12,000,000 organisms/100 ml. Seventy per cent of the samples treated were in excess of 1,000,000 organisms/100 ml. The contaminated water was passed through the apparatus at a flow rate of 1½ qts/min. which provided approximately a 1-minute exposure period of all the water so treated. Total count and MPN determinations were made on all samples, nonirradiated and irradiated. U-V absorption coefficients for these waters ranged from 0.10 to 0.57 with a predominance of samples at 0.25. These measurements were made with an apparatus designed and used for determining U-V transmission of water (Luckiesh, Taylor, Kerr, 1944). The absorption coef-

[1] Engineer, A. R. F. Products, Inc., River Forest, Ill.