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RECENT ADVANCES IN VIRUSES[1]

A BRIEF SURVEY OF RECENT WORK ON VIRUSES AND VIRUS DISEASES[2]

By Dr. EDWIN H. LENNETTE

SERVIÇO DE ESTUDOS E PESQUISAS SÔBRE A FEBRE AMARELA (YELLOW FEVER RESEARCH SERVICE)[3]

To formulate at the present time a concise, accurate and invariant definition of a virus is impossible due to the insufficiency of our knowledge concerning the nature of these disease incitants. Because the infectious agents classified as viruses possess the capacity to multiply or reproduce, because they showed marked specificity under natural conditions for certain hosts and tissues, are able to adapt themselves to new environmental conditions and to undergo variation, it is customary to regard them as living organisms. In the past viruses were characterized, and thus differentiated from bacteria, by the possession of a size at or below the limits of resolution possible with the usual microscopic methods, by their ability to pass through mineral or collodion filters which hold back bacteria, and by their total inability to reproduce in lifeless bacteriologic media. We now know, however, that invisibility and filtrability do not constitute valid criteria—some infectious agents possessing all the attributes of a virus and classed as such are visible and approximate the smallest bacteria in size while others pass with difficulty, or not at all, through filters which permit passage of the smallest bacteria. From the biologic standpoint the outstanding difference between viruses and bacteria appears to lie in the inability of viruses to propagate unless living cells are present; yet on closer analysis even this difference approximates the relative rather than the absolute in degree. Certain pathogenic bacteria, such as *Hemophilus influenzae* and *Pasteurella tularensis,* have become so highly parasitic that their nutritional requirements are

[1] Received for publication October 25, 1943.

[2] Presented on July 6, 1943, before the Seminario de Biologia, held in Rio de Janeiro from July 2 to 6, 1943, under the auspices of the University of Brazil.

[3] Maintained jointly by the Ministry of Education and Health of Brazil and the International Health Division of The Rockefeller Foundation.

the material contains its maximum water content, the evaporation of the water lowers its temperature far below that of the chamber. As the material becomes progressively drier its temperature becomes progressively higher, until finally both temperatures come close together. At this point, the material reaches a degree of dryness which is very close to the commonly desired moisture content.

The procedure consists of placing two thermometers in the dehydrator. The bulb of one thermometer is bare and is simply hanging in the chamber. The bulb of the second thermometer is covered with a definite amount of the dehydrating material contained in a small bag of cheesecloth and is placed on one of the loaded trays. The bag with the material is held around the bulb by rubber bands which tend to exert pressure continuously. The area and amount of material placed in the cheesecloth bag are definite and constant and are related to the amount and thickness of the layer of the material on the trays.

The cheesecloth bag technique is universal in application, in that, by means of it, almost any kind of material can be tied around the bulb of the thermometer. For example, peas and carrots can be tied as effectively and readily as slices of potatoes, apples or leaves of spinach.

The thermometers used in this method are specially devised and are well suitable for the purpose. They are electrical resistance thermometers, using, as resistor, a liquid instead of metal. They have a range from 2,500,000 ohms at 32° F. to 25,000 at 185° F. They are about 30,000 times more sensitive than the metallic electrical resistance thermometers. The electrical resistance values are read on a special wheatstone bridge. The bulb of the thermometers is made of glass and is 25 mm long and 8 mm in diameter. The wire leads are composed of the ordinary lamp-cord and can be of any length. These new electrical thermometers seem to be admirably suited for dehydration work. The wire leads make it possible and convenient to read the temperatures from the outside of the dehydrator.

The type of results obtained by this method is shown in Fig. 1. The material dehydrated is cabbage. It will be seen that the electrical resistance of the uncovered thermometer attains the temperature of the chamber very quickly and fluctuates as that temperature varies. The electrical resistance of the covered thermometer, however, remains at a higher level (lower temperature) for some time, and when the bulk of the water is evaporated, it begins to decrease, and finally almost reaches, to within 1,000 ohms, the resistance of the uncovered thermometer. At this point, the moisture content of the cabbage is 4.5 per cent., by vacuum oven determination, which is close to the lower range of the preferred moisture content. It is clearly evident from this chart that by calibration it is possible to know during the dehydration when the material has reached the desired moisture content.

The method has been tested on almost all the various materials commonly dehydrated, and in every case it has proven successful, dependable and accurate. Relying entirely upon this method, it has been possible to dehydrate many materials for the first time down to the preferred moisture content with surprisingly persistent accuracy and without resorting to any other aid. Results of checks agreed to within about 1 per cent.

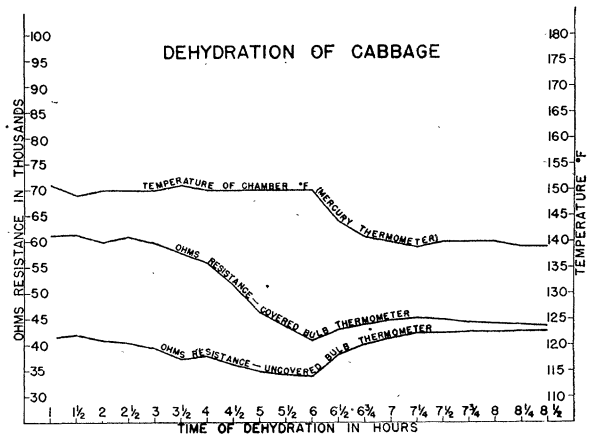

FIG. 1

While the method has been used thus far mainly in the non-moving type of dehydrators, there is no reason why it can not be adopted and used also in the conveyor or any other type of dehydrator.

The method is based upon sound fundamental principles and should fill the great need for a simple, direct and reliable method for indicating the moisture content of the dehydrating material, and for telling when the material has reached the desired moisture content and is ready to be taken out of the dehydrators. A comprehensive report is forthcoming.

GEORGE BOUYOUCOS
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BOOKS RECEIVED

BUNCH, C. C. *"Clinical Audiometry."* Illustrated. Pp. 186. C. V. Mosby Company. $4.00.

BYRD, OLIVER E. *Health Instruction Yearbook 1943.* Pp. ix + 308. Stanford University Press. $3.00.

LEADERMAN, HERBERT. *Elastic and Creep Properties of Filamentous Materials and Other High Polymers.* Illustrated. Pp. xii + 278. Textile Foundation, Washington, D. C.