SYMPOSIUM ON ENVIRONMENTAL BIOCHEMISTRY

Catalase and Protease Activities in Sewage, Sludges and Effluents

By M. K. C. SRIDHAR and S. C. PILLAI (*Department of Biochemistry, Indian Institute of Science, Bangalore-12, India*)

Catalase and protease activities were studied in (a) sewage, (b) sludges from treatment of sewage with lime, alum and ferric chloride, (c) septic-tank sludge, (d) activated sludge, (e) the protozoan *Epistylis articulata* associated with activated sludge, (f) the bacteria from the activated sludge and from the protozoan, (g) the supernatant liquids from sewage treated with lime, alum and ferric chloride, and (h) the effluents from the septic tank and activated-sludge process.

Of the different materials, *Epistylis articulata* showed the maximum amount of catalase activity, which was about five times that in activated sludge. The protozoan showed the minimum amount of protease, which was only about one-twentieth of that in activated sludge. The other sludges contained much less activities of the enzymes. Most of the effluents did not show any catalase or protease activity.

There was considerable similarity in the quality and quantity of the proteins in the activated sludge and in the protozoan. The bacteria flocculated around the protozoan in activated sludge showed less catalase activity and more protease activity than did the protozoan. The activated sludge prepared by acclimatizing it to a higher concentration of protein (casein) showed higher protease activity than did the normal activated sludge.

These observations are significant in giving an insight into the relationship of the bacteria and protozoa in the mechanism of purification of sewage, particularly by the activated-sludge process.

Long-Term Adaptation of Activated-Sludge Organisms to Accumulated Sludge Mass

By D. R. WASHINGTON (*Water Resources Centre, Ohio State University, 1791 Neil Avenue, Columbus, Ohio, U.S.A.*), L. J. HETLING (*New York State Department of Environmental Conservation, Albany, N.Y., U.S.A.*) and S. S. RAO (*Division of Laboratories, Ontario Department of Health, P.O. Box 9000, Terminal A, Toronto 1, Ont., Canada*)

In view of conflicting reports on the amount of sludge accumulation in extended-aeration activated-sludge systems, long-term experiments were con-

ducted under laboratory conditions with batch-type heterogeneous reactors. It was assumed as axiomatic that, for a given limited range of organic waste applied to a system, there must be a maximum range of population and mass of viable organisms that can survive in the activated-sludge medium. Continued accumulation of sludge mass beyond this range must be biologically inert organic matter. The major aim of this study was to determine whether or not sludge organisms could adapt themselves to the degradation of the accumulated organic solids in the system. This study revealed that a culture could develop that would decrease the accumulated biologically inert solids by about 50% when its principal source of carbon was glucose. The adapted organism(s) could be successfully inoculated into other systems. However, once the portion of the sludge to which the organism was adapted had been metabolized, it was unable to continue the degradation of this material as it was produced and the system returned to the initial rate of sludge accumulation. It is suggested that work directed towards the possible cyclic nature of the adaptation process over a period of several years of operation, survival of adapted organisms in a system of other predominance and the necessary conditions and time-dependence for such an adaptation be further investigated.

Application of Continuous-Culture Theory to Biological Waste-Treatment Systems

By R. H. SIDDIQI and B. K. HANDA (*Central Public Health Engineering Research Institute, Nehru Marg, Nagpur 3, India*)

Over the past decade an effort has been made by research workers in the sanitary-engineering field to rationalize the design procedures of biological waste-treatment systems. The formulations have been evolved mainly from experimental work involving pure cultures of micro-organisms and well-defined substrates. Sufficient field and laboratory results have now accumulated to validate these relationships for heterogeneous systems of biological waste treatment. The paper describes the performance of pilot-scale and laboratory-scale waste-treatment systems in the light of the formulations showing that these heterogeneous systems behave as tightly coupled systems. The kinetic constants of these systems are evaluated and compared with observations of other investigators for countries of temperate climate. The design procedure using the developed formulations is also included.