ENZYMATIC VS. MICROBIAL CONCEPTS OF UREA HYDROLYSIS IN SOILS

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Transformations of organic materials in soils have been almost universally assumed by soil scientists to be brought about by the direct action of microorganisms. According to this concept if any such transformation occurs in soils some microorganisms must be directly responsible. Recently, considerable evidence (2, 4, 5) has been collected which strongly suggests that some soil transformations at least are catalytic and indeed enzymatic in nature. Thus, in the presence in excess of the antiseptic toluene, a standardized percolation procedure secured a rather uniform rate of reduction in the concentrations of urea solutions percolated through some soils after the first percolates had been collected. Such uniform urea-splitting activities in the presence of toluene can be taken as direct evidence of enzyme behavior. Although no urease-like activity has been eluted from any of these soils, still other evidence (3) points to the presence in soils of enzymes or similar substances which are urease-like in their behavior.

In addition to these soils possessing a rather uniform urea-splitting ability, other soils exhibited, by the use of the same procedure, rapidly accelerated rates of urea decomposition as the percolations were continued. It is more difficult to interpret the behavior of these latter soils with simple enzyme behavior. A number of responsible microbiologists have informally suggested to the writer that microorganisms especially resistant to toluene or entirely indifferent to it might be present and by multiplying rapidly in its presence cause the accelerated urea decomposition noted. If this microbial concept were validated for these accelerated activities, it might easily suffice to explain the uniform activities of the first soils mentioned. This paper presents additional evidence attempting to determine whether microorganisms or enzyme-like substances are responsible for urea hydrolysis in the presence of toluene and other antiseptics.

PROCEDURE

Although the standardized procedure for conducting the percolations has been previously described (4), a brief resume is given here. For each unit percolation a 400-gram charge of dry soil was placed in a glass percolator provided with a suitable filter plate and paper. Successive portions of a standard urea solution (the initial portion large enough in volume to bring the soil mass to the verge of dripping, e.g., 150 cc, and later ones smaller and equal, e.g. 75 cc) were added at regular time intervals, generally either every 12 hours or every 24 hours unless

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3Figures in parenthesis refer to "Literature Cited", p. 1113.