THE METABOLISM of POLYCHLORINATED BIPHENYLS (PCBs) BY AQUATIC FUNGI.

by

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OBJECTIVES

The objective of this research is the investigation of the degradation and metabolism of the polychlorinated biphenyls (PCBs), Aroclor 1016 and Aroclor 1254 by Fusarium sp., an indigenous fungus, isolated from the sediments of the Hudson River. The studies on Aroclor 1016 will be done if time permits.

Specific Objectives and Questions to be Addressed:

1. Growth on PCBs
   a. What is the growth rate of Fusarium sp. on PCBs, a combination of PCB and an alternate, but simple, carbon source such as glucose or acetate, or on an alternate carbon source alone?
   b. Is the growth rate dependent on the concentration of PCB in the medium?
2. Degradation of PCBs
   a. What is the rate of PCB degradation?
   b. Which PCB classes are degraded preferentially?
   c. Is the rate of degradation altered by the presence of another source of carbon?
   d. Is the rate of degradation affected by the length of the incubation period?
3. Identification of PCB metabolites
   a. Does the fungus produce phenolic and/or carboxylic acid derivatives of PCBs?

b. Are these PCB derivatives the final metabolic products or can they be metabolized further with longer incubation periods?

4. Interaction of the Aroclors with Fusarium sp.

a. Does Fusarium sp. possess a hydrocarbon monooxygenase system (AHH) similar to that of mammals?

b. If present, is this monooxygenase system inducible by PCBs?

c. Is protein metabolism altered by fungi growing on PCBs?

d. Can changes in protein metabolism be detected at various time intervals following exposure to PCBs?

5. Survey of other fungal classes for their capacity to grow on and metabolize PCBs.

RATIONALE

The ubiquitous nature of PCBs, their toxic effects and their possible carcinogenicity prompted a search for an effective method of reducing their concentration in the environment. One such method, although of questionable validity, is the dredging of "hot" spots, areas heavily contaminated with PCBs, so as to reduce PCB content in such sediments. Dredging has been proposed with the assumption that PCBs are essentially non-biodegradable with a half-life of 75-100 years. The role of microorganisms in degrading PCBs has not been emphasized.

Recent studies, including work in our laboratory, have shown that a wide variety of microorganisms can degrade

PCBs. These results suggest that the half-life of PCBs in the environment may be considerably less than earlier estimates.

The role that fungi play in degrading PCBs in the aquatic environment has not been investigated. Fungi are ubiquitous in nature and possess a large reservoir of non-specific enzymatic systems capable of metabolizing a wide range of xenobiotics. Some fungi possess mixed function oxidase systems (MFO) that are known to affect the metabolism of aromatic hydrocarbons to which PCBs belong.

An understanding of the role that microorganisms play in the degradation of PCBs and the means by which they accomplish this will also help us in optimizing conditions for treating contaminated sediments and wastes if and when the need arises.