Removal and Destruction of CWA Simulants Using "Dry" Enzyme-Impregnated Fabrics & Coatings*

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Traditional aqueous-based enzymatic catalysis is limited by solubility of organic vapors in water and formation of a significant transport boundary at the liquid/air interface. To overcome these limitations, we have prepared 'dry' immobilized enzymes that are active in the absence of liquid water and can react directly with vapor substrates. These preparations are lightweight and have enhanced durability and thermostability due to resistance to conformational change in their dehydrated stateParathion hydrolase, a model agent-decontaminating enzyme, was produced, purified, and immobilized onto various fabrics and filters. Even though no free-flowing aqueous phase was in contact with the immobilized enzyme, it still retained activity such that it could degrade vapors of a chemical warfare agent simulant, methyl parathion. Special immobilization techniques, including the addition of enzyme stabilizers, enhanced the activity/stability of the enzyme in the dry-state and allowed quantitative destruction of methyl parathion in closed systems. These fabrics and filters can potentially be used for (1) decontamination of air (building filtration units, etc.), (2) protection of decon personnel from chemical warfare agents, and (3) reactive coatings for long-term decontamination of porous surfaces.

Biosketch

Brian H. Davison, Director of the Bioprocessing R&D Center, Oak Ridge National Laboratory is a biochemical engineer (Ph.D., California Institute of Technology) with experience in biodegradation of hazardous compounds via biofiltration and production of biological materials via fermentation. Current research has focused on nonaqueous biocatalysis examining direct reactions of vapors as well as oxidative reactions in organic liquid solvents. He is an author of over 60 publications and five patents. He recently led an integrated R&D project with four national labs and industry on production of biologically derived succinic acid. This process is being commercialized and was awarded an R&D100 award. He leads a Biochemical Engineering group with expertise in the above areas as well as microbial immobilization, bioreactor modeling, molecular biology, and enzyme modification.