TDMS0030 DATA EVALUATION RECORD PAGE 1 OF

CASE GS0014 ENDOSULFAN A - (11/21/79) STUDY 66 PM 110 12/26/79

CHEM 079401 ENDOSULFAN

BRANCH EFB DISC 30 TOPIC 050520

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 05012725 CONTENT CAT 01

MILES, J.R.W.; MOY, P. (1979) DEGRADATION OF ENDOSULFAN AND ITS METABOLITES BY A MIXED CULTURE OF SOIL MICROORGANISMS. BULLETIN OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY 23(1/2):13-19.

SUBST. CLASS = S.

DIRECT RVW TIME = 10 (MH) START-DATE END DATE

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CONCLUSIONS:

Metabolism - Effects of Microbes on Pesticides

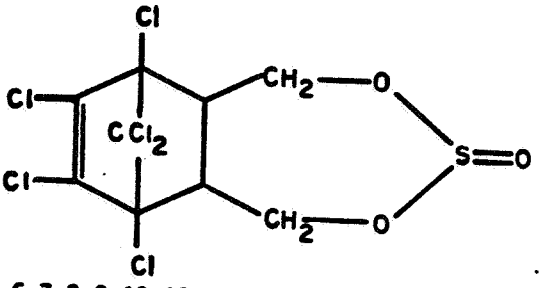
1. Results derived from this study are scientifically valid.

2. Mixed cultures of microorganisms isolated from a sandy loam soil are capable of transforming endosulfan and several of its metabolites in liquid culture media. A comparison of the half-lives for endosulfan derivatives in control versus inoculated culture media indicated that microbial enzymatic processes play a significant role in hastening the breakdown of the pesticide compounds. Analysis of the products produced from the action of mixed microbial populations of endosulfan substrates yielded a possible scheme for microbial endosulfan degradation in the environment.

3. Information contained within this study is useful in fulfillment of the data requirements in Section 163.62-8(f)(2) of EPA's Proposed Guidelines for Registering Pesticides (July 1978) by providing information on microbial metabolism of endosulfan in a sandy loam soil.

MATERIALS AND METHODS:

ENDOSULFAN, BENZOEPIN, BEOSIT, CHLORTIEPIN, CYCLODAN, INSECTOPHENE, MALIX, THIFOR, THIMUL, THIODAN, THIONEX, THIOSULFAN, TIONEL, TIOVEL



6,7,8,9,10,10-Hexachloro-1,5,5a,6, 9,9a-hexahydro-6,9-methano-2,4, 3-benzodioxathiepin-3-oxide

A nutrient medium (500 ml) consisting of KH_2PO_4, K_2HPO_4, NH_4NO_3, $MgSO_4 \cdot 7H_2O$, $CaCl_2$, and $Fe(SO_4)_3$ at pH 6.5 was added to dissolved analytical grade insecticide standards of α- and β-endosulfan, endosulfan sulfate, endosulfan diol, endosulfan ether, endosulfan hydroxyether, and endosulfan lactone to yield a final concentration of 1 mg/liter of the appropriate pesticide. Mixed culture inoculants were obtained by shaking 100 g of sandy loam soil with 200 ml of distilled water. After allowing the sand to settle for 10 seconds, 20 ml of the supernatant was withdrawn and added to each of the seven incubation flasks. Following incubation for time intervals of 1, 2, 3, 4, 6, 8, 12, 16, and 20 weeks, flasks were placed in an ultrasonic bath for 15 minutes, and 10 ml aliquots subsequently were removed and extracted with hexane. The extracts were analyzed by electron capture gas chromatography.

REPORTED RESULTS:

Microbial conversion of the endosulfan substrates occurred as depicted in Figure 1. A characteristic rapid degradation of substrate accompanied by a simultaneous increase in the corresponding metabolic conversion product was observed for each endosulfan compound as shown in Figure 2 for α-endosulfan. With few exceptions, the data from Table 1 demonstrate that most of the endosulfan metabolites were stable in the control media. Therefore, the conversions that occurred in the inoculated media can be attributed to enzymatic processes of the introduced microorganisms.

DISCUSSION:

1. As the present studies were conducted in aqueous media, the results obtained may more accurately reflect the interactions of mixed populations of bacteria leading to degradation of endosulfan in aquatic environments rather than in agricultural soils.

2. Microbial metabolism was shown to have raised the pH of the culture media from an initial value of 6.5 to a final value of 7.6. The large quantity (74-77%) of endosulfan diol produced from endosulfan may be attributed somewhat to the rise in pH of the culture medium, as it is known that significant chemical hydrolysis of endosulfan to endosulfan diol occurs at alkaline pH.

3. Although pesticide conversion rates are higher in the inoculated samples than in the sterile controls, it is difficult to distinguish conversion due to enzymatic processes from conversion attributable to modification of the chemical environment (e.g., influence of increased pH).

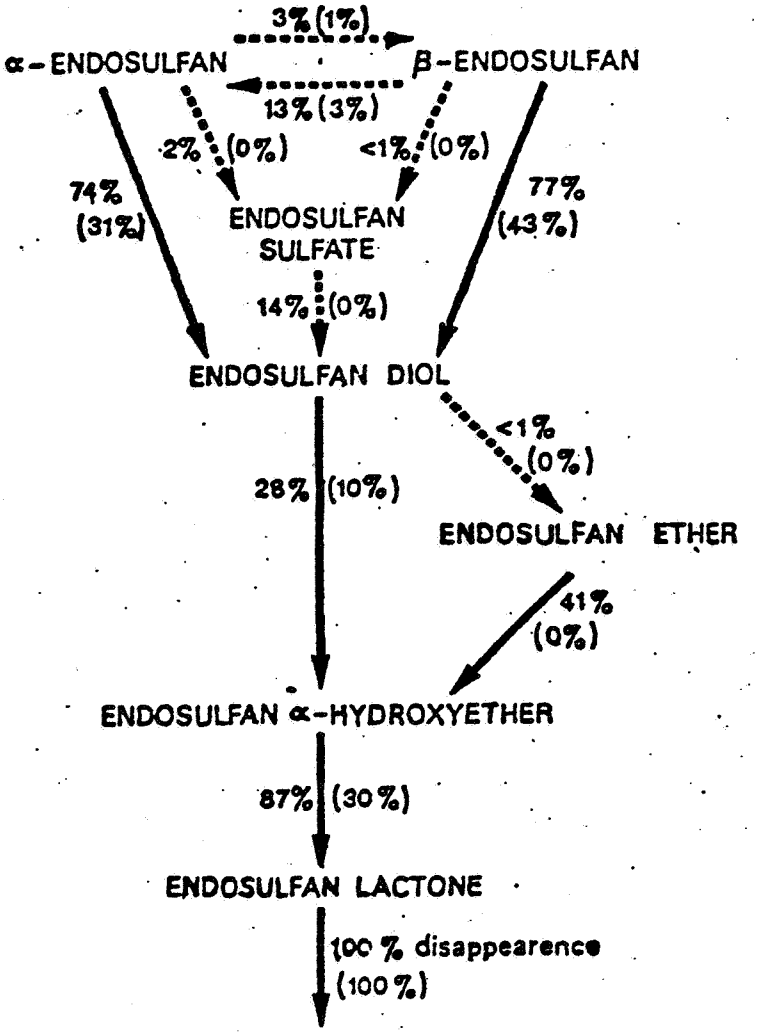


Figure 1. Conversion of α- and β-endosulfan and metabolites in aqueous nutrient medium inoculated with a mixed culture of soil microorganisms and in sterile medium (bracketed numbers).

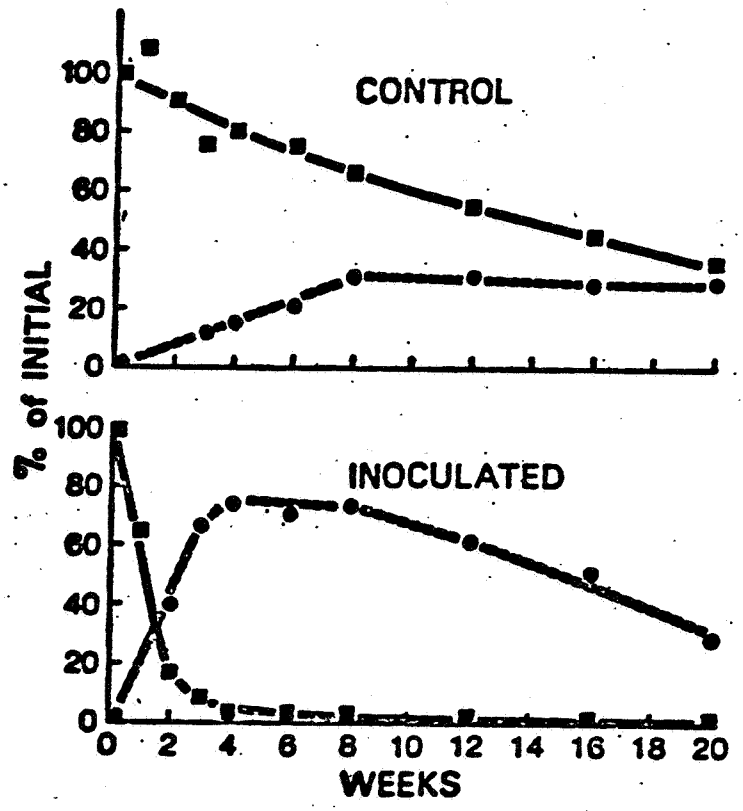


Figure 2. Degradation of α-endosulfan (1 ppm) in control nutrient medium and in medium inoculated with microorganisms from sandy loam.

■———— α-endosulfan
●- - - - - - - β-endosulfan diol produced from -endosulfan diol (values adjusted for M.W.; i.e., $\frac{407}{361} = 1.13$)