The objectives of this research are to conduct laboratory experiments that will predict the photochemical and biological transformations of DCPD and DIMP in the soils and waters of Rocky Mountain Arsenal and will provide a semiquantitative evaluation of decomposition rates of and products resulting from DCPD and DIMP. During July, this project was initiated and preliminary investigations in analytical chemistry, microbiology, and photochemistry were performed. Arrangements have been made to collect field samples at Rocky Mountain Arsenal in August. This will enable us to initiate the studies to obtain acclimated cultures for the biodegradation phase of this project. Analytical work on DCPD will continue, and the photochemical studies will be initiated. Exhibit A is a preliminary performance schedule for this project. Exhibit B depicts the expenditure of funds.

DTIC QUALITY INSPECTED 3
STUDIES OF ENVIRONMENTAL FATES OF DIMP AND DCPD

Monthly Progress Report 1
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By:
Ronald J. Spanggord, Ph.D.
Tsong-Wen Chou, Ph.D.
William R. Mabey, Ph.D.

Prepared for:
Commander
U.S. Army Medical Research and Development Command
ATTN: SGRD-UBG
Fort Detrick
Frederick, Maryland 21701

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William Dennis, Project Officer
SRI Project LSU-7551

Approved by:

Peter Lim, Director
Pharmaceutical Analysis Department

W. A. Skinner, Executive Director
Life Sciences Division

333 Ravenswood Ave. • Menlo Park, California 94025
(415) 326-6200 • Cable: STANRES, Menlo Park • TWX: 910-373-1246
Introduction

The U.S. Army Medical Bioengineering Research and Development Laboratory has the responsibility of developing environmental standards for pollutants that contaminate the environment at Army installations. Two such pollutants at the Rocky Mountain Arsenal are dicyclopentadiene (DCPD) and diisopropylmethylphosphonate (DIMP).

The objectives of this research are to conduct laboratory experiments that will predict the photochemical and biological transformations of DCPD and DIMP in the soils and waters of Rocky Mountain Arsenal and will provide a semiquantitative evaluation of decomposition rates of and products resulting from DCPD and DIMP.

Progress

During July, this project was initiated and preliminary investigations in analytical chemistry, microbiology, and photochemistry were performed.

Analytical Chemistry

Arrangements were made with the project officer to have samples of DIMP, isopropylmethylphosphonate, and methylphosphonic acid shipped to SRI.

DCPD, obtained from Columbia Organic Chemicals (purity 99%), was found to be 96% pure by gas chromatographic analysis. Analysis of the impurities by gc/ms showed that they were mainly oxygenated derivatives of DCPD (see Figure 1 and attachments). These derivatives may be expected in photochemical or microbial transformation studies.

Biodegradation

A preliminary test for toxic effects of DCPD was conducted with microorganisms collected from a eutrophic pond in Woodside, California, and from SRI soil. Mixed cultures of microorganisms were grown for 24 hr in shaker flasks containing basal salts medium with glucose and yeast extract at 25° C. These organisms were used to inoculate media containing 10 and 50 ppm DCPD. Microbial growth was measured by the turbidity of the broths. Table 1 presents the average turbidities of duplicate flasks after 16 and 40 hours of growth compared with control flasks. These data indicate that DCPD does not inhibit the growth of these organisms at up to 50-ppm concentration levels.
Table 1

EFFECT OF DCPD ON CELL GROWTH

<table>
<thead>
<tr>
<th>Microorganism Source</th>
<th>DCPD Concentration (ppm)</th>
<th>Turbidity (% of Control) at 16 hr</th>
<th>Turbidity (% of Control) at 40 hr</th>
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</table>

Photochemistry

A preliminary analysis of the uv spectrum of DCPD has shown that the extinction coefficients above 230 nm are less than 83 molar\(^{-1}\) cm\(^{-1}\). More spectra will be measured for accurate determination of the extinction coefficients (or lower limits), especially in the solar spectrum region above 290 nm.

Future Work

Arrangements have been made to collect field samples at Rocky Mountain Arsenal in August. This will enable us to initiate the studies to obtain acclimated cultures for the biodegradation phase of this project.

Analytical work on DCPD will continue, and the photochemical studies will be initiated.

Exhibit A is a preliminary performance schedule for this project. Exhibit B depicts the expenditure of funds.
<table>
<thead>
<tr>
<th>TASK DESCRIPTION</th>
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*Notes:*
- Months and weeks are placeholders for actual values.
- Δ indicates the timing of specific tasks or reports.
EXHIBIT B  EXPENDITURES

Funds
108 -
99 -
90 -
81 -
72 -
63 -
54 -
45 -
36 -
27 -
18 -
9 -

Actual

Projected

Months
1 2 3 4 5 6 7 8 9 10 11 12
SCAN 125  0.00 MINUTES  INGERSOLL  DICYCLOPENTADIENE, -GC
BACKGROUND SUBTRACTED
mixture: M 146 dicyclonoctadiene (major)
M' 134 dicyclooctadiene (minor)

Scan 120 9.16 minutes
Ingersoll Dicyclopentadiene, -GC

Background subtracted
dicnopentadiene
dicyclopentadiene
Scan 136 13.00 Minutes
Background subtracted

Ingersoll Dicyclopentadiene, -GC

dicyclopentadiene
SCAN 137 13.58 MINUTES  
BACKGROUND SUBTRACTED

INGERSOLL DICYCLOPENTADIENE, -GC

? $C_{10}H_{10}O$
Dicyclopentadiene - dco

Scan 1-4 16.04 minutes
Background subtracted