A THESIS

entitled

STUDIES ON THE BEHAVIOUR OF CERTAIN PESTICIDES IN EGYPTIAN SOIL

Presented by

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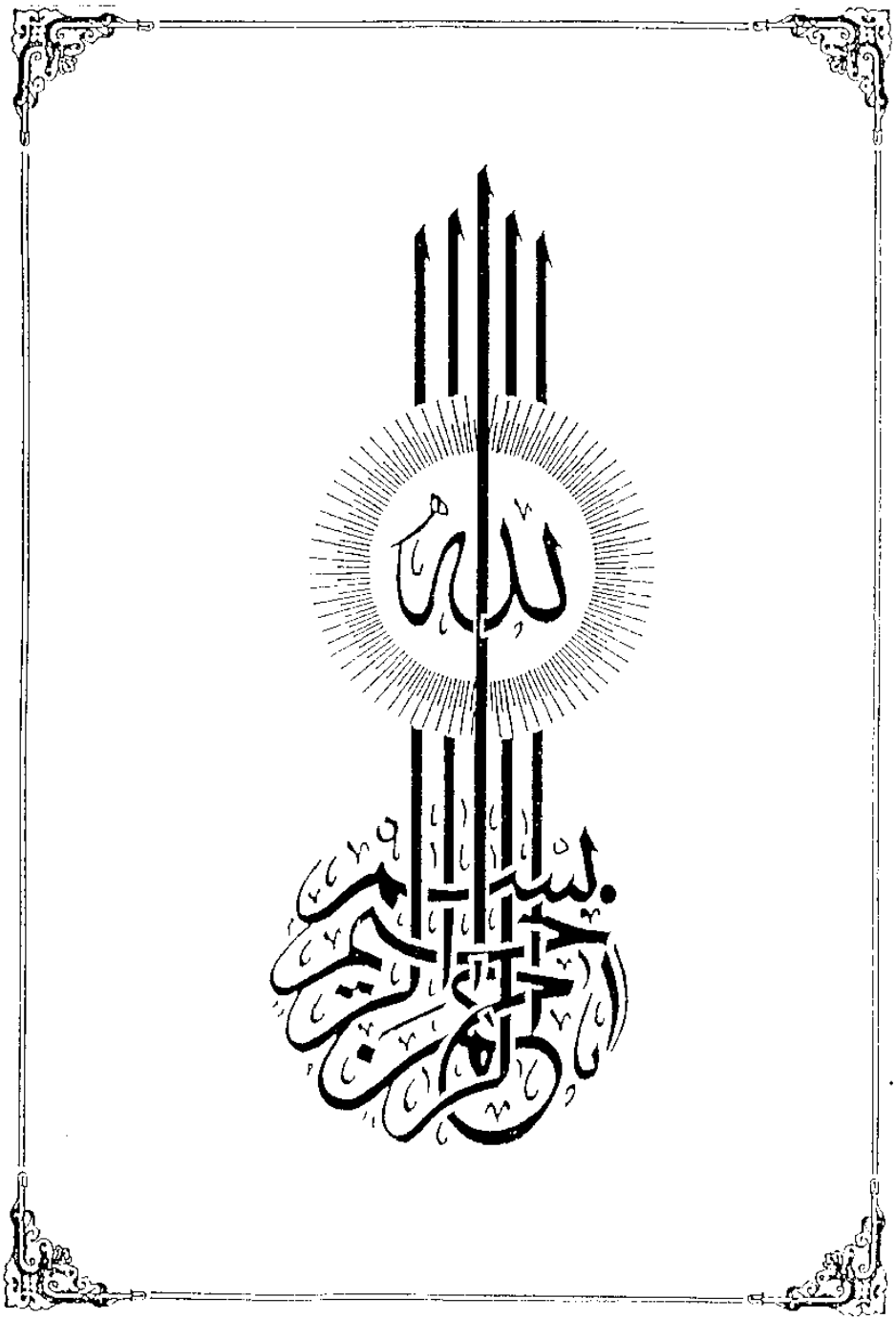

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N O T E

Besides the work carried out in this thesis the candidate has attended post-graduate course for two years in organic chemistry including the following topics:-

1- Reaction mechanisms.

2- Electronic, Infrared, Raman and n.m.r. Spectroscopy of Organic Molecules.

3- Micro-analysis.

4- Chemistry of Heterocyclic Compounds.

5- Organic Reactions.

She has successfully passed an examination in these topics.

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PART I: DEGRADATION OF DALAPON

SUMMARY

Investigations were performed to study the adsorption of dalapon (2,2-dichloro propionic acid) and its rate of degradation in clay and sand soils, and in their enriched cultures. Effect of organic matter on dalapon degradation was also investigated. The following is a summary of the results obtained:

1) Adsorption of dalapon in clay and sand soils is rather similar and maximum adsorption was attained within 2 hours of equilibrium in both soils.

2) For each soil, the amount of adsorbed dalapon increases with increase of the incubated amount of dalapon. This relation is reversed when the amount adsorbed is expressed in percentage.

3) Dalapon is degraded at a much greater rate in clay than in sand soil, and also greater in non-sterilized than in sterilized soil.
Increasing the amount of incubated dalapon resulted in decreasing the rate of degradation.

4) Chloride ions and pyruvic acid were the two degradation products detected in soils and their liquid cultures

treated with dalapon.

5) Liberated chloride ions were accumulated in soil and culture and its curve took the shape of a sigmoid or S-shape. Whereas, the produced pyruvate disappeared rather fast under all conditions. Pyruvate curve has an inverted U-shape.

AIM OF THE PRESENT INVESTIGATION

The halogenated aliphatic acids have been known for many years, but their use as herbicides is very recent. The major herbicides in this group according to their importance are, trichloroacetic acid (TCA),2,2-dichloropropionic acid (dalapon),2,2-dichlorobutyric acid, and 2,3-dichloroisobutyric acid. α-chlorination appears to be a major requirement for activity, thus TCA, dalapon, and 2,2-dichlorobutyric acid are the most active herbicides in this group.

The announcement of dalapon (the sodium salt of 2,2-dichloropropionic acid), in 1953 a systemic grass selective herbicide represented a promising new approach to chemical weed control. It was first made available by the Dow chemical company for industrial weed control, later on it showed a considerable promise for certain selective agricultural uses.

Herbicides as inhibitors for biological systems, may exert simultaneously a deleterious effect on the population of soil microflora. Numerous groups of micro-organisms on the other hand, can adapt themselves, after a lag period, to decompose these toxic chemicals to inactive products.

Such a phenomenon obviously includes the cleavage of the ring to make use of the carbon atoms locked in this ring to produce the required energy for the maintenance and growth of such organisms.

The detoxication of halogenated compounds by micro-organisms is well knwon in the halogenated aliphatic acids and this mechanism may also occur in halogenated aromatic structures, although it is carried out more easily after the ring fission. The aromatic ring is usually hydroxylated as the first step in its oxidation. The hydroxylated ring then suffers a fission to change into an aliphatic compound and this cleaves into simpler compounds which are used by the organism to produce energy and cell components.

The aim of this study is to investigate the fate of certain herbicides which are used in Egypt on a large scale.

A great deal of the work has been carried out on the degradation of these herbicides under different conditions in both soil and microbial liquid cultures. The study was also focused on the effect of added organic matter, the type of soil, and sterilization on the disappearance of herbicides in soil.

PART I

DEGRADATION OF DALAPON

INTRODUCTION

CHAPTER I

INTRODUCTION

I- Physical and Chemical Properties of the Chlorinated Aliphatic Acids:

Replacement of hydrogen with a halogen in the aliphatic acids yields derivatives which ionize to a greater extent than if unsubstituted. The halogens, being strongly electronegative, tend to attract electrons. Thus the inductive effect of the chlorine makes the chlorinated aliphatic compounds stronger acids than the corresponding acetic or propionic acids.[1] Within the group of chlorinated aliphatic acids there are two kinds of phytotoxicity. Some chlorinated aliphatic acids are capable of producing an acute contact burn (chloroacetic acid, trichloroacetic acid (TCA), or dalapon) probably because they are both strong acids and protein precipitants. Another type of response, is a systemic effect which can result in the selective control of grasses apparently results from lower concentration and the effect shows primarily in meristems or growing points.[1]

Leasure[1] reported that chloroformic acid, chloro - acetic, and dichloroacetic acid are all inactive as selective