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ENVIRONMENTAL IMPACT AND SIGNIFICANCE OF PESTICIDES

W.M.J. Strachan, W.A. Glooschenko, and R.J. Maguire

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Chapter 2

BASIC PRINCIPLES AND PRACTICES ON THE ANALYSIS OF PESTICIDES

Alfred S. Y. Chau and Hing-Biu Lee

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I. INTRODUCTION

Pests have long been known to man. The Old Testament has many references to plagues of locust, to wines "eaten by the worms", and the olive "that cast his fruit". There are numerous forms of pests and as many attempted control measures. Formulations prepared from plant extracts such as nicotine or simple inorganic salts such as arsenic compounds were perhaps the earliest forms of pesticides recorded in ancient documents of more than several hundreds of years ago in old countries such as China. It was not until 1939, however, that the ability of the xenobiotic compound DDT, to control undesirable insects was discovered. Subsequently, methoxychlor, a DDT analog, was also found to be effective against a wide range of insects, although in some instances it is less effective than DDT. Later, in 1945, the discovery of a plant growth regulator known as 2,4-D, a phenoxyalkanoic acid, opened the door for the discovery of a multitude of similar compounds which are used as herbicides to control undesirable weeds by their selective action on broadleaf plants. Since then, chemicals for pest control have had a dramatic rise in types, number, and quantity. Although these chemicals control insects, weeds, and other pests and hence increase agricultural products and minimize diseases to humans and animals, some can also remain active in the environment for long periods of time, and some can affect the nontarget organisms such as fish and wildlife. The bioaccumulative tendency and nontarget side effects of these chemicals could pose a hazard to health and to the environmental ecosystem. Therefore, the monitoring and surveillance of these chemicals in food and in the environment is a necessary and basic step for health protection, environmental assessment, and pollution control. In the latter case, for example, the identification, characterization, and measurement of the concentration of pollutants in the environment provide not only a better understanding of the extent and effects of pollution, but also of the effectiveness of existing and new pollution control action.

Pesticides can be defined as substances that kill or control some unwanted organisms such as insects, fungi, undesirable plants, rodents (rats and mice), mites, or nematodes. According to their intended targets, pesticides can be more accurately classified into the following groups, namely, insecticides, fungicides, herbicides, rodenticides, miticides, and nematocides. For example, insecticides are agents to control or kill harmful insects affecting plants, animals, and humans; fungicides are substances that prevent, cure, or control plant diseases caused by fungi; herbicides are substances that kill weeds or increase or decrease plant growth or alter these states to increase their benefit to man. These three classes of pesticides are the most widely used. Included in the general term of pesticides could also be antibiotics, defoliants, and desiccants. An individual chemical can have two or more functions, acting, for example, as an insecticide as well as fungicide.

Chapter 3

POSITIVE IDENTIFICATION OF PESTICIDE RESIDUES BY CHEMICAL DERIVATIZATION-GAS CHROMATOGRAPHIC TECHNIQUE*

Alfred S. Y. Chau

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I. GENERAL DISCUSSION OF SEVERAL CONFIRMATORY TECHNIQUES

A. Introduction

As discussed later on the analysis of pesticide residues, gas-liquid chromatographic (GLC or GC) techniques in conjunction with selective and specific detectors such as the electron-caputred and flame photometric detectors are the most widely used instruments and probably the key practical instruments used in routine analysis of low level pesticide residues in environmental sample. Although GC/MS systems can now generally meet the sensitivity of these selective or specific detectors, they are not as widely used as the gas chromatography-selective or specific detector system. This is probably because a sensitive GC/MS system suitable for routine monitoring of trace organics in the aquatic system has only recently been available. Moreover, the initial cost could be prohibitive to many laboratories. Therefore, the gas chromatograph with specific detectors still is a main tool in pesticide analysis. These systems are used complimentary to one another in the few laboratories that are fortunate enough to have both for trace analysis.

Chapter 4

THE CHEMISTRY OF THE CYCLODIENE INSECTICIDES

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