THE FATE OF DDT AND CHLORPYRIFOS APPLIED TO A MODEL ECOSYSTEM SIMULATING A TROPICAL MARINE ENVIRONMENT.

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DECLARATION.

This thesis is my original work and has not been presented for a degree in any other University.

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This thesis has been submitted for examination with our approval as University supervisors.

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ABSTRACT.

A study of dichlorodiphenyltrichloroethane {DDT} and Chlorpyrifos was conducted using a model aquarium simulating a tropical marine ecosystem. The ecosystem comprised sea water, sediment, oysters and three species of fish: Dory snapper fish (*Luthrinus fulviflama*), Rabbit fish (*Siganus stellatus*) and Black emperor fish (*Lethrinus harak*). DDT and chlorpyrifos insecticides and the metabolites of DDT were then monitored over a period of 672 hours using Liquid Scintillation Counting and Gas Chromatography (GC) with Electron Capture Detector (ECD) techniques. The distribution of pesticide residues among the ecosystem components, the rate of loss of the pesticide residues from biota to sea water and the dissipation trends of the pesticides from sea water were assessed.

Water having a concentration of 1.2 ng/g of DDT was found to have lowered its DDT concentration to 0.4 ng/g in 168 hours although equal amounts of the pesticide was injected in intervals of 24 hours within the 168 hours. By contrast, oysters and sediment had their DDT concentrations rise from 126 to 1308 ng/g and 1 to 117 ng/g respectively in the same period. In another system containing water and sediment only, the DDT concentration in the former declined from 20.5 ng/g to 1.1 ng/g while in the latter it rose from 2.6 ng/g to 18.8 ng/g in a period of 168 hours.

The concentration of chlorpyrifos rose from 2 ng/g to 4 ng/g in water within a week as equal amounts of the pesticide were injected into the water at 24 hour intervals. Similarly, in the same ecosystem *Luthrinus fulviflama, Siganus stellatus*, oysters, and sediment had their pesticide concentrations rise from 190 to 421 ng/g, 207 to 584 ng/g, 134 to 450 ng/g, and 14 to 20 ng/g respectively within 168 hours. In a system comprising water and sediment only, chlorpyrifos concentrations of 42.7 ng/g in water declined to 3.1 ng/g in 168 hours while that of sediment rose from 2.8 to 9.8 ng/g in the same period.

Oysters having DDT concentrations of 936 ng/g were noted to lose 34% of the pesticide when exposed to fresh sea water within 168 hours. By contrast, *Lethrinus harak*, *Siganus stellatus* and oysters containing chlorpyrifos at concentrations of 541 ng/g, 219 ng/g and 160 ng/g respectively, lost 64%, 50% and 26% respectively of the pesticide under similar conditions.

Chlorpyrifos was found to have half-lives of 4.2 days and 7 days in the two species of fish, *Lethrinus harak* and *Siganus stellatus,* respectively. By contrast, DDT at concentrations of 27 and 33 ng/g in aerated and non-aerated waters was found to have half-lives of 3 hours 20 minutes and 3 hours 45 minutes, respectively. Half-lives of 13 hours 21 minutes and 24 hours 3 minutes were observed for concentrations of 33 ng/g and 27 ng/g of chlorpyrifos in aerated and non-aerated waters, respectively.

DDT degradation in sea water gave dichlorodiphenyldichloroethylene {DDE} as the major metabolite while in sediment, dichlorodiphenyldichloroethane {DDD} was the major metabolite.

From the results obtained, it was concluded that higher concentrations of pesticide residues in a marine ecosystem are absorbed by biota (e.g fish and oysters) and to a lesser extent get adsorbed to sediment. Fish loses pesticide residues to fresh sea water at a higher rate compared to oysters. The rate of loss of pesticide from aerated water is higher than from the non-aerated. The rate of loss of DDT from water was higher than for chlorpyrifos as implied by their half-lives.