THE DISTRIBUTION, FATE AND EFFECTS OF ^{14}C-DDT IN MODEL ECOSYSTEMS SIMULATING TROPICAL FRESH WATER ENVIRONMENT

By

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A thesis submitted in partial fulfilment of the degree of Master of Science of the University of Nairobi.

September, 1999

DECLARATION

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

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

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ABSTRACT

The distribution, accumulation, depuration, degradation, and effects of a uniformly labelled p,p'-dichlorodiphenyl-1,1,1-trichloroethane (^{14}C-DDT) in model fresh water ecosystems simulating Lakes Naivasha, Baringo and Victoria were studied in the laboratory by fetching water, sediment, fish (*Tilapia zilli* and *Tilapia niloticus*) and water lily (*Victoria reja*) from the lakes. ^{14}C-DDT distributed rapidly in the ecosystem immediately after application of the pesticide on the water surface. Its concentration declined in the water phase by about 45% after only 2 hours and increased in the sediment and fish. The sediment served as a sink accumulating 27% to 37% of the pesticide during this period of time.

The bioconcentration ratio (BCR) varied with concentration and species of fish and reached a maximum of 2017 in *Tilapia zilli* for single dosing while a bioconcentration factor of 2234 was calculated for repeated dosing in the same fish. The depuration of the accumulated pesticide from *Tilapia nilotica* was steady but incomplete, only 59.5% being eliminated after 72 hours in uncontaminated water. The rate, however, was very fast and only 2.8 hours was needed for the concentration to decline by 50%.

The acute toxic effect of the pesticide on fish as manifested in shuddering, darting, side swimming and death was found to be species dependent. A concentration of 0.1 μg/ml ^{14}C-DDT, which was a non-observable toxic effect concentration (NOTEC) to *Tilapia nilotica*, was found to be a lethal acute toxic effect concentration to *Tilapia zilli*. Furthermore, the toxicity study with one species of fish (*Tilapia zilli*) demonstrated that the rate of uptake and metabolism and not the extent of exposure

determine the lethal acute toxic effect of DDT on fish.

The Gas chromatographic analysis of the fish, water, sediment and water lily samples revealed the presence of DDT and substantial amount of its primary metabolites, DDE and DDD, 24 hours after spiking. The major degradation product of the pesticide in fish and water was DDE whereas DDD was the major degradation product in sediment.