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Assessment of impact of pesticides on water catchments and groundwater in some selected areas of Sri Lanka

by

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Declaration

The work described in this thesis was carried out by me under the supervision of Dr. Sudantha Liyanage, Dr. (Mrs.) Janitha A. Liyanage and Dr. A. M. Mubarak and a report on this has not been submitted in whole or in part to any university or any other institution for another Degree/Diploma.

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Signature of the candidate

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ABSTRACT

Environmentalists and general community are concerned about the impact of pesticides on the environment. Systematic methods of assessment of potential risk of pesticides to environmental components can serve as valuable tools in decision-making and policy formulation. The objectives of this study were; to rank commonly used pesticides in Sri Lanka according to their pollution potential on surface and groundwater using an indicator model, field residual monitoring to measure actual risk on surface and groundwater and compare with the observed risk with prediction of indicator model.

High recharge rate due to excessive irrigation, sandy soil with low organic matter and shallow water table depth are features of the Kalpitiya area which are expected to contribute to high risk on groundwater. Some surface water reservoirs which are fed by agricultural catchments, located in the Walawe area are used as sources for public water supplies therefore the surface water pollution potential is high. Kalpitiya peninsula and Walawe area were selected for the study.

Relative risk of pesticide in terms of mobility and toxicity on surface and groundwater were assessed using an indicator model namely Pesticide Impact Rating Index. Shallow domestic wells which were located around agricultural plots of both Walawe and Kalpitiya areas and the man made reservoirs in Walwe area were monitored for commonly used pesticides. According

to PIRI prediction; out of commonly used pesticides in Kalpitiya area, Carbofuran and Dimethoate fall into "Extremely high" risk category and Imidaclorpride falls into "Very high" risk category for groundwater contamination potential. Out of commonly used pesticides in Walawe area Carbofuran and 2,4D fall into Extremely high and Very high risk categorise, respectively for groundwater mobility. The mobility risk of the selected pesticides for surface water of Kattakaduwa Wewa and Metigath Wewa is very low.

Applied pesticide on agricultural fields at the recommended rate(department of agriculture), were not found in wells which were located, 5-10 m away from the agricultural plots in Kalpitiya where Diazinon, Carbaryl, Methomyl, Imidacloprid, Fenthion, Captan, Carbofuran, Dimethoate, Chlorpyrifos and Oxyfluorfen are widely used and 1 to 3 m outside of the paddy fields in Walawe area where 2, 4 D, MCPA, Propanil, Diazinon, Carbofuran, Dimethoate, Chlorpyrifos, Oxyfluorfen and Fenthion are widely used. Residues of commonly used Pesticide were not detected in the reservoirs of Kattakaduwa Wewa, Metigath Wewa and Pathirana Wewa which are fed by either 100% drainage water or the reservoir of Habaralu Wewa, Kiri-ibban Wewa, Chandrika Wewa and Sooriya Wewa which are fed mainly by non-agricultural drainage. According to the field trials, when pesticides applied at the recommended rate and agricultural plots were irrigated at the average rate of 20mm/day, Dimethoate, Carbofuran, and Chlorpyrifos leached to 3m water table of Kalpitiya at 24±4 days, 25±3 days and 35±6 days after application of each pesticide respectively but Diazinon, Carbaryl, Methomyl, Imidacloprid, Fenthion, Captan, and Oxyfluorfen are not detected. The result from the case studies matched with the PIRI prediction, 100% for surface water and 74% for and groundwater.