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Adsorption, Desorption and Degradation of Pesticides Widely Used in Sri Lankan Agriculture and Their Persistence in Soils of Different Agro-Ecological Environments.

By

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ABSTRACT

Adsorption, Desorption and Degradation of Pesticides Widely Used in Sri Lankan Agriculture and Their Persistence in Soils of Different Agro-Ecological Environments.

Pesticide usage have significantly increased due to modern agricultural production to control weeds, insects other pests and disease. In Sri Lanka pesticide use has significantly increased year by year. Therefore, this study was undertaken to find out consumption behaviors of some popular pesticides and to study their sorption and degradation patterns from some selected Sri Lankan soils. A survey completed for 02 agricultural potential areas viz Kalpitiya and Walawa basins, revealed that pesticides malpractices and available water for consumption are quite common and unsuitable respectively. Pesticides undergo a variety of physical, biological and chemical process such as sorption (adsorption/desorption), degradation (chemical/ biological) surface run off, leaching, plant uptake and volatilization. However in this study attention was paid only for sorption and degradation behaviors of two common pesticides w ith s ome selected s oils in S ri Lanka. Forty three (44) surface soil (A_P horizon) were collected from 28 different soil series in the wet zone and 15 soils series selected in the dry zone and pesticides Carbofuran and Diuron were selected to study the soil sorption study. High Performance Liquid Chromatography (HPLC) method was used for pesticide analysis. Three different types o f sorption experiments were conducted on the two p esticides, n amely s orption kinetics, multiple point sorption isotherms and single point sorption coefficients. Sorption data for both pesticides at concentration 0.1 mg/L level followed linear sorption behavior in all soils with coefficient of determination (R^2) more than 0.97. It was assumed that the plots for Carbofuran and Diuron passed through the origin. The Linear Sorption Partition Coefficient K_d, for both pesticides is highest in Nuwara Eliya soil which has the highest organic carbon percentage of 7.6. The adsorption partition coefficient was lowest in the Urrbrae soil having the lowest organic c arbon p ercentage of 1.4. The l inear sorption partition coefficients estimated were not significantly different to the estimates using sorption isotherms. The multiple regressions of the K_d for Diuron against % SOC, % Clay and pH was very significant, with the coefficients for % SOC being significant at the $P \leq 0.001$ level. For degradation study, Carbofuran and Diazinon was used for 04 soil types (Kalpitiya, Negombo, P ugoda and N uwara Eliya) in S ri Lanka. Both p esticides

showed a slow degradation rates in all selected soils. Nuwara Eliya exhibited the lowest. After 58 days, the mineralized carbon percentage was less than 20% in all 04 soils. Degradation of both Carbofuran and Diazinon was rapid in sandy soils like Negombo and Kalpitiya. It was very slow in Nuwara Eliya soil, which has the highest amount of organic carbon amongst the selected soils. Literature reveals the relationship between sorption and the degradation. Therefore Nuwara Eliya soil high sorption rate due to degradation become low rate. Soil microbial degradation which is expected to be increased with the organic carbon content is very slow under conditions prevailing in Sri Lanka and chemical or other degradation may occur in those soils rather than the microbial actions. Number of studies in literature highlighted the variations of pesticide contamination potential in different soils under different climatic conditions. Comparison of risks were done using indices computed using the variables representing pesticide, soil, climatic and management practices. Retardation factor (RF) and Attenuation factor (AF) have been used to evaluate the key surface and groundwater contamination potential. The RF scheme revealed the 05 soil series have high leaching risk due to low retardation ability. Also AF scheme showed that the Ethabatuwa and Pugoda soil series have exhibited the high leaching risk for Carbofuran.