

ABSTRACT

Physico-chemical studies on dieldrin, (1R, 4S, 5S, 8R) - 1, 2, 3, 4, 10, 10-hexachloro-1, 4, 4a, 5, 6, 7, 8, 8a - octahydro - 6, 7 - epoxy - 1, 4, 5, 8 - dimethanonaphthalene; endosulfan 1, 4, 5, 6, 6, 7 - hexachloro - 8, 9, 10 - trinorborn - 5 - en - 2, 3 -ylene dimethyl sulfite; and vamidothion, O, O-dimethyl - S - 2 - (1 - methylcarbamoylethylthio)ethyl phosphorothioate; were carried out under laboratory and field conditions, characteristic of tropical agroecosystems. Laboratory studies included measurement of spectral characteristics and rates of volatilisation, hydrolysis, photolysis and leaching in soils. Field studies included measurement of dissipation rates of endosulfan and dieldrin in coffee and citrus plantations and vamidothion in coconut.

Spectral characteristics which included uv; i.r., N.M.R. and M-S were recorded, analysed and used for identification and confirmation of the test compounds and attempts were made to use uv and i.r. to study environmental behaviour. Volatility from E.C. formulations on glass surfaces at 30°C were in the order α -endosulfan > dieldrin > β -endosulfan. Plots of $\ln F$ vs $(\text{time})^{1/2}$ gave excellent linear correlation coefficients with $F_{1/2}$ values between 2 to 11 days. Hydrolytic degradation rates of endosulfan at 30°C decreased with pH in the sequence pH 9.5 ($t_{1/2} \approx 0.04$ days) > pH 7.0 ($t_{1/2} \approx 25$ days) > pH 4.5 ($t_{1/2} \approx 90$ days). Hydrolysis of dieldrin was insensitive to pH, over the same range $t_{1/2} \approx 95$ days. Hydrolysis of vamidothion showed an initial first order phase with $t_{1/2}$ (pH 4.5) aqueous buf-

fer) = 33 days and $t_{1/2}$ (coconut water pH 4.5) = 37 days. Photolysis rates using a mercury lamp were dieldrin ($t_{1/2}$ = 2.5 hrs) > β -endosulfan ($t_{1/2}$ = 3.5) hrs) > α -endosulfan ($t_{1/2}$ = 20 hrs) for hexane solutions and in aqueous solutions dieldrin ($t_{1/2}$ = 1.7 hrs) > β -endosulfan ($t_{1/2}$ = 33 hrs) > α -endosulfan ($t_{1/2}$ = 48 hrs). Photolysis rates in sunlight were in the same order but $t_{1/2}$ was between 20 - 40 days for bulk hexane solutions while as a thin layer of hexane solution $t_{1/2}$ = 15 hrs of sunlight for each compound. Over 90% of endosulfan and dieldrin remained in the 0 - 5 cm layer of soils leached with up to 100 cm water.

Pseudo-first order half-times for surface residues of endosulfan and dieldrin on coffee leaves in the field were about 20 days and for total residues $t_{1/2}$ was about 22 and 35 days for endosulfan and dieldrin respectively. Differences in formulation and effect of shading vs direct sunlight were insignificant except for W.P. formulation of dieldrin in shade, ($t_{1/2}$ = 42 days). More than 85% of dieldrin and endosulfan remained in the 0 - 3 cm layer of soils under citrus with $t_{1/2}$ values of 86 and 68 days respectively. Residues of vamidothion in coconut tissues reached a maximum of 3.2 ppm 12 days after injection into the trunk and declined to 0.2 ppm after 109 days.