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DATA EVALUATION RECORD

STUDY 6

CHEM 057701 Malathion §163-1

FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 41345201
Blumhorst, M. R. 1989. Adsorption/desorption studies - batch equilibrium for malathion. Laboratory Report No. 135-001. Unpublished study performed by EPL Bio-Analytical Services Inc., Harristown, IL, and submitted by the Malathion Reregistration Task Force.

DIRECT REVIEW TIME = 8

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CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

1. This study can be used towards the fulfillment of data requirements.

2. EFGWB concludes that malathion is moderately to very mobile in sandy loam, sand, loam, and silt loam soils, since Freundlich K_{ads} values varied from 0.828-2.47; while K_{oc} values varied from 151-308.

3. This study is acceptable and partially fulfills EPA Data Requirements of Registering Pesticides by providing information on the mobility (batch equilibrium) of unaged malathion in sand, loam, silt loam, and sandy loam soils.

4. Malathion was relatively stable under the experimental conditions of the study, although significant degradation occurred between the adsorption and desorption of the solutions in two of the soils used. The *B*-monocarboxylic acid of malathion was the primary metabolite detected in these soils accounting for 13.8-19.2% of the applied radioactivity. This is not unexpected given the rapid hydrolysis and degradation of malathion that occurred in the hydrolysis and the aerobic soil metabolism and anaerobic aquatic metabolism studies.

5. No additional information on the mobility of unaged malathion in soil is required at this time. Data are needed on the mobility of aged malathion residues in soil.

METHODOLOGY:

Hanford sandy loam, Centhan sand, Blackoar loam, Mexico silt loam, and Foley-Calhoun-McCrary complex sandy loam soils (Table I) were air-dried and sieved (2-mm). Based on preliminary batch equilibrium experiments, a soil:water ratio of 1:5 and equilibration time of 2 hours were chosen for the definitive experiment.

For the definitive experiment, subsamples of the soils (4.0 g) were weighed into glass centrifuge tubes. Aliquots (20 mL) of 0.01 M calcium chloride solution containing ^{14}C-malathion (radiochemical purity 96.0%, specific activity 90 uCi/mg, Amersham) plus unlabeled malathion (purity 98.4%) at 91-123, 9.19-12.4, 1.01-1.34, or 0.197-0.229 ug/mL were added to the soil. The slurries were shaken on an orbital shaker for 2 hours at 22° C, centrifuged, and a portion (10 mL) of the supernatant was removed. An aliquot of the supernatant was assayed by LSC; the remainder was used for TLC analysis.

The desorption phase of the study was performed by replacing the supernatant (10 mL) with pesticide-free 0.01 M calcium chloride solution. The tubes were sealed and shaken for 2 hours. The slurries were centrifuged, and a portion (10 mL) of the supernatant was removed and replaced with an equal amount of pesticide-free 0.01 M calcium chloride solution. Aliquots of the supernatants were assayed by LSC; the remainder was used for TLC analysis. Subsamples of the soil were analyzed by LSC following combustion; additional subsamples were analyzed by direct scintillation counting.

The adsorption and desorption supernatants that had a high initial malathion concentration were analyzed using one-dimensional TLC on silica gel plates developed in benzene:hexane:acetic acid (40:40:10, v:v:v) or hexane:acetic acid:ethyl ether (75:15:10, v:v:v). The radioactive areas were visualized using autoradiography. Reference standards cochromatographed on the same plate were visualized with iodine. [^{14}C]Residues were scraped from the plates and eluted from the silica gel with methanol. Aliquots of the eluate were analyzed for total radioactivity using LSC. Additional aliquots were analyzed for specific compounds using HPLC on ODS columns eluted with an acetonitrile:phosphate buffer gradient and with UV detection (220 nm).

DATA SUMMARY:

Based on batch equilibrium studies, [^{14}C]malathion (radiochemical purity 96.0%) plus unlabeled malathion (purity 98.4%) at 91-123, 9.19-12.4, 1.01-1.34, and 0.197-0.229 ug/mL was determined to be very mobile in two sandy loams, sand, loam, and silt loam soil:0.01 M calcium chloride solution slurries that were equilibrated for 2 hours at 22 C. Freundlich K_{ads} values were 0.828 and 1.60 for the Hanford sandy loam and the Foley-Calhoun-McCrary complex sandy loam soils, respectively; 1.23 for the sand soil; 1.76 for the loam soil; and 2.47 for the silt loam soil (Table II). Respective Koc values were 151, 267, 308, 176, and 183. K_{des} values were 0.887 and 2.03 for the Hanford sandy loam and the Foley-Calhoun-McCrary complex sandy loam soils, respectively; 1.67 for the sand soil; 1.63 for the loam soil; and 2.08 for the silt loam soil.

Malathion was relatively stable during the batch equilibrium study. Following the adsorption phase of the study, malathion was 86.2-100% of the recovered radioactivity, malaoxon was $\leq$1.0%, dicarboxylic acid degradates were $\leq$2.0%, and monocarboxylic acid degradates were $\leq$9.9% (Tables VIII, X, XII, XIV, and XVI). Following the desorption phase of the study, malathion was 73.9-100% of the recovered radioactivity, malaoxon was $\leq$3.6%, malathion dicarboxylic acid was $\leq$2.3%, and malathion beta monocarboxylic acid was $\leq$19.2% (Tables IX, XI, XIII, XV, and XVII).

REVIEWER'S COMMENTS:

1. Preliminary experiments demonstrated that malathion did not adsorb to the glass centrifuge tubes used in the study.

2. Material balance varied from 96.68 to 99.84%.

3. Malathion adsorption by the soils generally increased as soil organic matter, clay content and cation exchange capacity increased.

MALATHION

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