DATA EVALUATION RECORD

STUDY 2

CHEM 060101 Thiabendazole §162-2

FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 41559601
Daly, D., and M. Williams. 1990. Anaerobic soil metabolism of ^{14}C-thiabendazole. ABC Final Report No. 37640. Unpublished study performed by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO, and submitted by MSD AGVET, Division of Merck and Company, Inc., Rahway, NJ.

DIRECT REVIEW TIME = 8

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CONCLUSIONS:

Metabolism - Anaerobic Soil

1. This study can be used to fulfill data requirements.

2. [^{14}C]Thiabendazole was relatively stable in sandy loam soil which was anaerobically incubated in the dark for 60 days following an aerobic incubation period of 30 days. The only degradate detected throughout the study was benzimidazole.

3. This study is acceptable and fulfills EPA Data Requirements for Registering Pesticides by providing information on the anaerobic (nitrogen plus flooding) metabolism of phenyl ring-labeled [^{14}C]thiabendazole in soil.

4. No additional information is needed on the anaerobic metabolism of phenyl ring-labeled thiabendazole in soil at this time.

METHODOLOGY:

Phenyl ring-labeled [^{14}C]thiabendazole (radiochemical purity 98.6%, specific activity 24.77 uCi/mg; MSD AGVET) was applied at 1 ug/g to sandy loam soil (58% sand, 30% silt, 12% clay, pH 7.8, 0.9% organic matter, CEC 9.2 meq/100 g) which had been air-dried, sieved through a 2-mm mesh screen, and stored in a plastic bag in the dark at room temperature for 58 days prior to use. After treatment, the soil was moiscened to 70-75% of field capacity, placed in a sealed chamber (Figure 1), and aerobically incubated for 1 month in the dark at 24-26 C. Humidified air was drawn through the system and vented through ethylene glycol, sulfuric acid and KOH traps. Following the aerobic aging period, glucose (1%) was added to the test soils, which were then flooded with well water. The chamber was flushed with nitrogen and incubated for an addicional 60 days under the conditions described above. (Ic was unclear if che humidified air that had been concinuously drawn through the system was replaced wich nitrogen gas.) Duplicate samples were collected at 0, 1, 3, 7 and 14, and 30 days posttreatment, and at 15, 30, 45 and 60 days after the establishment of anaerobic conditions (45, 60, 75 and 90 days posctreatment).

Soils were extracted by the procedure shown in Figure 3. Samples were centrifuged and the water layer was decanted; aliquots of the wacer were analyzed by LSC. The samples were mixed with 1 N methanolic KOH, placed on a mechanical shaker for 2 hours, and centrifuged for 10 minutes. The extract was decanted and the soil was rinsed twice with methanolic KOH; the rinsates were combined (Soil Extract I) and analyzed by LSC. A single aliquot of the extract was concentrated under nitrogen and neutralized with HCl; the mixture was centrifuged and the supernatant was analyzed by reverse-phase HPLC using a mobile phase of water:acetonitrile:H_3PO_2 (75:25:0.04, v:v:v) with UV-detection; fractions were collected and analyzed by LSC. Identification of compounds was done by comparison of the retention times of the parent and degradates with those of reference standards (Figure 2). The extracted soil was further extracted with 6 N HCL:dimethylformamide (1:1, v:v; Soil Excract II). Soil samples were shaken, centrifuged, and rinsed as described above; an aliquot of the extract was analyzed by LSC. An additional aliquot of the extract was adjusted to pH 12.0. The extract was then partitioned twice with ethyl acetate, and triplicate aliquots of the aqueous and organic phases were analyzed by LSC. An aliquot of the organic phase was reduced to dryness under nitrogen and the residues were redissolved in methanol. The mixture was vortexed and analyzed by reverse-phase HPLC as described above. To confirm the presence of the parent compound and the degradate benzimidazole, selected extracts were analyzed using two-dimensional TLC on silica gel plates

developed in the first direction with dioxane:toluene:ammonium hydroxide (8:1:1, v:v:v) and in the second direction with butanol:water:acetic acid (65:25:10, v:v:v). Non-radiolabeled standards were cochromatographed with the soil extracts and visualized under UV light. Radioactive areas on the plates were located by autoradiography and were scraped from the plates and analyzed by LSC.

To quantify non-extractable residues, the soil was dried under nitrogen and combusted in triplicate; the evolved $^{14}CO_2$ was quantified by LSC. Trapping solutions were also analyzed in triplicate to quantify volatile [^{14}C]residues.

DATA SUMMARY:

Phenyl ring-labeled [^{14}C]thiabendazole (radiochemical purity 98.6%), at 1.04 ug/g, was relatively stable in sandy loam soil incubated in the dark at 25 C under anaerobic conditions (nitrogen and flooding) for 60 days following a 30-day aerobic incubation period under similar conditions. Parent thiabendazole was 88.3% of the applied immediately posttreatment, 74.0% at day 30, and 78.0% at day 90 (day 60 post-flooding; Table V). The degradate

benzimidazole

was present at a maximum of 13.7% of the applied at day 1 posttreatment, decreasing to 8.3% by 30 days posttreatment and 5.5% by 90 days (60 days post-flooding, Table VI). Non-extractable residues increased from 0.62 to 5.8% of the applied during the first 30 days posttreatment, and were 5.5-6.2% throughout the remainder (anaerobic portion) of the study. At 90 days posttreatment, cumulative volatiles accounted for 0.820% of the applied. Material balances were 95.3-102.9% of the applied.

COMMENTS:

1. The study authors calculated a half-life for thiabendazole of 211 days for the aerobic-incubation portion of the study. The statistical estimations of the anaerobic soil metabolic half-life of thiabendazole reported in this experiment are of limited value because the calculations involve extrapolation considerably beyond the experimental time limits of the study. Data are often incapable of accurately predicting trends outside of their range because small differences are magnified and reactions which appear to be linear may, in fact, be curvilinear.

2. The study authors did not clearly indicate whether the flow of air through the system was replaced with nitrogen after the nitrogen purge of the system when the tubes were flooded, or if the air flow through the system was resumed.