Adsorption/Desorption (Batch Equilibrium) of Pymetrozine

Report: Gohdes, M. (1996) CGA-215944: The Adsorption and Desorption of (carbon-14) CGA-215944 on Representative Agricultural Soils: Lab Project Number: CHW 6117-293: 501-95. Unpublished study prepared by Corning Hazleton Inc. 99 p.

Document No.: MRID 44024969

Guideline: OPPTS 835.1230

Classification: This study is classified as Acceptable. This study is scientifically valid and provides useful information on the soil mobility (batch equilibrium) of pymetrozine in five soils. This signature and classification supersedes the denotation of "draft" on the following page.

PC Code: 101103

Reviewer: Jessica L. O. Joyce, Fate Scientist
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Rochelle F.H. Bohaty, Senior Scientist
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DATA EVALUATION RECORD

DRAFT

STUDY 6a

CHEM 101103 Pymetrozine §163-1
CAS No. 123312-89-0
FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 44024969

Gohdes, M. 1996. The adsorption and desorption of ^{14}C-CGA-215944 on representative agricultural soils. Unpublished study performed by Corning Hazleton Inc., Madison, WI; and submitted by Ciba-Geigy Corporation, Greensboro, NC.

DIRECT REVIEW TIME = 42 Hours

REVIEWED BY:	J. Salemme, Ph.D.	Signature:
TITLE:	Senior Scientist	Date:
EDITED BY:	C. A. Little, Ph.D.	Signature:
TITLE:	Sr. Scientist/Asst. Project Manager	Date:
APPROVED BY:	P. H. Howard, Ph.D.	Signature:
TITLE:	Project Manager	Date:
ORG:	Syracuse Research Corp. Arlington, VA 22202	
TEL:	703/413-9369	

APPROVED BY:	Dan Rieder
TITLE:	Branch Chief
ORG:	ERB III/EFED/OPP
TEL:	703/305-5314

SIGNATURE:

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CONCLUSIONS

Mobility - Leaching & Adsorption/Desorption

1. This study is scientifically valid and provides useful information on the soil mobility (batch equilibrium) of pymetrozine (CGA-215944) in five soils.

2. This study meets Subdivision N Guidelines for the partial fulfillment of EPA data requirements on soil mobility (batch equilibrium).

3. Triazine ring-labeled [6-^{14}C]pymetrozine, at nominal concentrations of 0.54, 1.07, 2.53, and 4.77 µg/mL (or 0.51, 1.03, 2.66 and 5.36 µg/mL for Ashkum-Elliott loam soil only), was determined to be very mobile in sand soil:solution slurries and mobile in sandy loam, Bosket loam, silty clay loam, and Ashkum-Elliott loam soil:solution slurries that were equilibrated for 24 hours at 25 ± 1 °C. Freundlich K_{ads} values were 6.6 for the sand soil, 14.0 for the sandy loam soil, 18.9 for Bosket loam soil, 27.1 for the silty clay loam soil, and 30.9 for Ashkum-Elliott loam soil; corresponding K_{oc} values were 1,394, 5,833, 7,875, 3,080 and 1,500 mL/g, respectively. Respective 1/N values for adsorption were 0.41, 0.45, 0.56, 0.57, and 0.65. Freundlich K_{des} values determined after a 24-hour equilibration period were 8.4 for the sand soil, 18.9 for the sandy loam soil, 37.7 for Bosket loam soil, 38.9 for the silty clay loam soil, and 47.5 for Ashkum-Elliott loam soil; corresponding K_{oc} values were 1,789, 7,875, 15,708, 4,420 and 2,306 mL/g, respectively. Respective 1/N values for desorption were 0.67, 0.70, 0.66, 0.64, and 0.71. During the 24-hour adsorption equilibration period, 10.5-36.5% of the applied radioactivity was adsorbed to the sand soil (across all application levels), 23.6-61.6% was adsorbed to the sandy loam soil, 36.2-66.5% was adsorbed to Bosket loam soil, 45.0-77.3% was adsorbed to the silty clay loam soil, and 51.4-75.7% of the applied was adsorbed to Ashkum-Elliott loam soil. Following a single 24-hour desorption equilibration period, 49.7-64.5% of the previously adsorbed radioactivity was desorbed from the sand soil, 36.6-49.0 % was desorbed from the sandy loam soil, 17.2-31.7% was desorbed from Bosket loam soil, 16.5-32.4% was desorbed from the silty clay loam soil, and 15.3-29.3% was desorbed from Ashkum-Elliott loam soil. The reviewer-calculated coefficient of determination (r^2) values for the relationships K_{ads} *vs.* organic matter and K_{ads} *vs.* pH (based on reported r values) were 0.57 and 0.74, respectively.

METHODOLOGY

Based on the results of preliminary studies of the adsorption of the triazine ring-labeled [6-^{14}C]pymetrozine ((E)-4,5-dihydro-6-methyl-4[3-pyridinylmethylene)amino]-1,2,4-triazin-3-(2H)-one; radiochemical purity 98.3%, specific activity 41.1 µCi/µg; p. 12) to Plainfield sand, Hanford sandy loam, Bosket loam, Gadsden silty clay loam, and Ashkum-Elliott loam soils, an adsorption equilibration period of 24 hours was chosen

(Tables 3, 4; pp. 35, 36). In a preliminary study to determine the stability of the test compound, degradation of the parent compound during the 24-hour equilibration period was not observed (Tables 5, 6; pp. 37, 38). Material balance results from the preliminary studies indicated that the test compound did not adsorb to the test vessels (p. 28).

For the adsorption phase of the definitive study, aliquots (10 mL) of 0.01 M $CaCl_2$ solution treated with triazine ring-labeled [6-^{14}C]pymetrozine (dissolved in methanol), at nominal concentrations of 0.54, 1.07, 2.53, and 4.77 µg/mL (or 0.51, 1.03, 2.66, and 5.36 µg/mL for Ashkum-Elliott loam soil only), were added to silanized glass test tubes containing samples (0.5 g) of air-dried, sieved (2 mm) Plainfield sand, Hanford sandy loam, Bosket loam, Gadsden silty clay loam, and Ashkum-Elliott loam soils (Tables 1, 2; pp. 33, 34). Duplicate samples were prepared for each soil type/treatment rate combination. The soil:solution slurries (1:20 w:v) were equilibrated by shaking in a water bath for 24 hours at 25 ± 1 °C (p. 21). Following the adsorption equilibration period, soil:solution slurries were centrifuged and the supernatants decanted. Triplicate aliquots of each supernatant were analyzed for total radioactivity by LSC; the detection limit was reported to be 34 dpm, twice background (p. 26).

For the desorption phase of the definitive study, an aliquot (10 mL) of pesticide-free 0.01 M $CaCl_2$ solution was added to each of the soil pellets from the adsorption phase of the study (p. 21). The soil:solution slurries were equilibrated by shaking in a water bath for 24 hours at 25 ± 1 °C. Following equilibration, the soil:solution slurries were centrifuged and the supernatants decanted. Triplicate aliquots of the desorbate from each sample were analyzed for total radioactivity by LSC.

Following the desorption phase, the soil was analyzed for total radioactivity by LSC following combustion (p. 21).

To determine the viability of the soils prior to treatment, soil samples (with the exception of Ashkum-Elliott loam soil) were diluted, plated and analyzed visually for microbial growth; separate counts of aerobic and anaerobic microorganisms were performed (p. 15). Results indicated that the soils were viable.

DATA SUMMARY

Triazine ring-labeled [6-^{14}C]pymetrozine (radiochemical purity 98.3%), at nominal concentrations of 0.54, 1.07, 2.53, and 4.77 µg/mL (or 0.51, 1.03, 2.66, and 5.36 µg/mL), was determined to be very mobile in Plainfield sand soil:solution slurries, and mobile in Hanford sandy loam, Bosket loam, Gadsden silty clay loam, and Ashkum-Elliott loam soil:solution slurries that were equilibrated for 24 hours at 25 ± 1 °C. Freundlich K_{ads} values were 6.6 for the sand soil, 14.0 for the sandy loam soil (0.4% o.m.), 18.9 for Bosket loam soil (0.4% o.m.), 27.1 for the silty clay loam soil, and 30.9 for Ashkum-

Elliott loam soil (3.5% o.m.); corresponding K_{oc} values were 1,394, 5,833, 7,875, 3,080, and 1,500 mL/g, respectively (Table 9, p. 41). Respective 1/N values for adsorption were 0.41, 0.45, 0.56, 0.57 and 0.65. The reviewer-calculated coefficient of determination (r^2) values for K_{ads} versus organic matter and K_{ads} versus pH were 0.57 and 0.74, respectively. Freundlich K_{des} values determined following a 24-hour equilibration period were 8.4 for the sand soil; 18.9 for the sandy loam soil; 37.7 for Bosket loam soil; 38.9 for the silty clay loam soil, and 47.5 for Ashkum-Elliott loam soil; corresponding K_{oc} values were 1,789, 7,875, 15,708, 4,420, and 2,306 mL/g, respectively. Respective 1/N values for desorption were 0.67, 0.70, 0.66, 0.64, and 0.71.

During the 24-hour adsorption equilibration period, 10.5-36.5% of the applied radioactivity was adsorbed to the sand soil (for individual replicates across all application levels), 23.6-61.6% of the applied radioactivity was adsorbed to the sandy loam soil, 36.2-66.5% of the applied radioactivity was adsorbed to Bosket loam soil, 45.0-77.3% of the applied radioactivity was adsorbed to the silty clay loam soil, and 51.4-75.7% of the applied radioactivity was adsorbed to Ashkum-Elliott loam soil (Tables 7, 8; pp. 39, 40). Following a single 24-hour desorption equilibration period, 49.7 %- 64.5% of the previously adsorbed radioactivity was desorbed from the sand soil, 36.6%-49.0 % was desorbed from the sandy loam soil, 17.2%- 31.7% was desorbed from the Bosket loam soil, 16.5 %- 32.4% was desorbed from the silty clay loam soil, and 15.3%-29.3% was desorbed from the Ashkum-Elliott loam soil (Tables 10, 11; pp. 42, 43).

Material balances (for individual replicates) across all application rates were 97.5-105.1% for the sand soil, 96.7-104.7% for the sandy loam soil, 97.2-102.8% for Bosket loam soil, 95.2-102.6% for the silty clay loam soil, and 95.6-98.5% for Ashkum-Elliott loam soil (Tables 12, 13; pp. 44, 45).

COMMENTS

1. The qualitative classifications of soil mobility reported in the conclusions and data summary were determined by the reviewer using "Table III: The general relationship between the soil/solution partition coefficient K, R_f, and soil mobility" (*Federal Register*, Vol. 44, No. 53) and are based on the K_{ads} values (Freundlich) reported by the study author. The qualitative determinations reported by the study author in the form of a McCall mobility class were based on K_{oc} values associated with the adsorption phase of the experiment (p. 31). It is preferred that the reported mobility class be based on K_{ads} values.

2. The Hanford sandy loam soil was the same type of soil used in two aerobic soil metabolism studies (MRID 44024965 and 44024966) of parent pymetrozine (CGA-215944; pp. 21, 25).

3. The reviewer noted that the limit of detection was reported (p. 26), but that the limits of quantitation were not. It is necessary that both limits of detection and quantitation be reported to allow the reviewer to assure the adequacy of the method.