

US EPA ARCHIVE DOCUMENT

CONCLUSIONS

Mobility - Leaching & Adsorption/Desorption

1. This study is scientifically valid and provides useful information on the soil mobility (batch equilibrium) of the metsulfuron methyl degradate triazine amine.
2. This study does not meet Subdivision N Guidelines for the partial fulfillment of EPA data requirements on soil mobility (batch equilibrium) for the following reasons:
 - (i) desorption of the test compound was studied at only a single application rate, precluding the calculation of valid desorption coefficients;
 - (ii) it could not be determined if one of the soils used was the same type of soil used in the aerobic soil metabolism study; and
 - (iii) method detection limits were not reported.
3. The metsulfuron methyl degradate triazine ring-labeled [2-¹⁴C]triazine amine, at nominal concentrations of 0.1, 0.5, 1.0 and 5.0 µg/mL, was determined to be very mobile in silt loam, sandy loam, silty clay loam and sand soil:solution slurries (1:1, w:v) that were equilibrated for 24 hours at 25°C. Freundlich K_{ads} values were 2.36 for the silt loam soil, 0.62 for the sandy loam soil, 6.80 for the silty clay loam soil, and 0.26 for the sand soil; corresponding K_{oc} values were 214, 134, 226 and 46 mL/g. Respective 1/N values were 0.84, 0.78, 0.84 and 0.87. Since desorption was studied at only one concentration, the calculation of valid desorption coefficients was precluded. Reported registrant-calculated K_{des} values (which were calculated from desorption-series data for a single concentration) are not included in this review.

METHODOLOGY

Based on the results of a preliminary study of the adsorption of the metsulfuron methyl degradate triazine ring-labeled [2-¹⁴C]triazine amine (4-methoxy-6-methyl-1,3,5-triazine-2-amine; radiochemical purity > 99%, specific activity 18.3 µCi/mg) to silt loam, sandy loam, silty clay loam and sand soils, an adsorption equilibration period of 24 hours was chosen (p. 21; Table 3, p. 28). In a preliminary study, adsorption of the test compound to the polyethylene test bottles was not observed (p. 21; Tables 3, 4; pp. 28, 29). 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 (p. 22).

For the adsorption phase of the definitive study, aliquots (20 mL) of 0.01 M CaCl₂ solution treated with triazine ring-labeled [2-¹⁴C]triazine amine (dissolved in methanol),

at nominal concentrations of 0.1, 0.5, 1.0 and 5.0 $\mu\text{g/mL}$ (p. 16), were added to polyethylene bottles containing subsamples (20 g) of air-dried, sieved (2 mm) Matapeake silt loam, Sassafras sandy loam, Drummer silty clay loam and Myaka sand soils (Table 1, p. 26). Duplicate bottles were prepared for each soil type/treatment rate combination; additional sets of duplicate bottles containing untreated 0.01 M CaCl_2 solution and soil, and 0.01 M CaCl_2 solution treated at 5.0 $\mu\text{g/mL}$ without soil were prepared as controls. The soil:solution slurries (1:1, w:v) were equilibrated by shaking in a water bath for 24 hours at 25°C; control bottles were equilibrated in the same manner as the sample slurries. Following the adsorption equilibration period, soil:solution slurries were centrifuged and the supernatants decanted. Duplicate aliquots of each supernatant were analyzed for total radioactivity by LSC; the detection limit was not reported.

For the desorption phase of the definitive study, an aliquot of pesticide-free 0.01 M CaCl_2 solution, equivalent to the volume of solution removed after adsorption, was added to the soil pellets (and the control bottles) from the adsorption phase of the study; only samples treated at 5.0 $\mu\text{g/mL}$ were studied. The soil:solution slurries were equilibrated by shaking in a water bath for 24 hours at 25°C. Following equilibration, the soil:solution slurries were centrifuged and the supernatants decanted. The desorption step was repeated twice to produce desorption series data. Duplicate aliquots of the desorbate from each sample were analyzed for total radioactivity by LSC.

To determine the stability of the test compound under test conditions, soil samples were extracted following the third desorption period by adding 10 mL of methanol to the soil pellet, shaking for 30 minutes, centrifuging and decanting. The extraction was repeated and the extracts combined. Soil extracts and an aliquot of the adsorbate from one of each of the soil:solution slurry replicates treated at 5.0 $\mu\text{g/mL}$ were analyzed by HPLC (PRP-1 column with Zorbax C18 pre-column) using a mobile phase of acetonitrile:aqueous 0.1% phosphoric acid plus aqueous 0.1% triethylamine (1:99 to 10:90) with radioactive flow detection (p. 18); method detection limits were not reported. Data from the HPLC analysis of the methanol extracts indicated that the parent was stable throughout the definitive study (p. 24). Soil extracts were analyzed for total radioactivity by LSC and post-extraction soil samples were analyzed for residual [^{14}C]radioactivity by LSC following combustion.

DATA SUMMARY

The metsulfuron methyl degradate triazine ring-labeled [^{14}C]triazine amine (radiochemical purity > 99%), at nominal concentrations of 0.1, 0.5, 1.0 and 5.0 $\mu\text{g/mL}$, was determined to be very mobile in silt loam, sandy loam, silty clay loam and sand soil:solution slurries (1:1, w:v) that were equilibrated for 24 hours at 25°C. Freundlich K_{ads} values were 2.36 for the silt loam soil, 0.62 for the sandy loam soil (0.8% o.m.), 6.80 for the silty clay loam soil (5.2% o.m.), and 0.26 for the sand soil; corresponding K_{oc}

values were 214, 134, 226 and 46 mL/g (Table 13, p. 38). Respective 1/N values were 0.84, 0.78, 0.84 and 0.87. Since desorption was studied at only one concentration, the calculation of valid desorption coefficients was precluded. Thus, reported registrant-calculated K_{des} values (which were calculated from desorption-series data for a single concentration) are not included in this review.

During the 24-hour adsorption equilibration period, 67%-81% of the applied radioactivity was adsorbed to the silt loam soil (for all replicates across all application levels; Table 5, p. 30), 31%-53% of the applied radioactivity was adsorbed to the sandy loam soil (Table 6, p. 31), 87%-94% of the applied radioactivity was adsorbed to the silty clay loam soil (Table 7, p. 32), and 17%-27% of the applied radioactivity was adsorbed to the sand soil (Table 8, p. 33). Following a single 24-hour desorption equilibration period for soil samples treated at the highest nominal application rate (5.0 $\mu\text{g/mL}$), 6.3%-7.6% of the adsorbed radioactivity was desorbed from the silt loam soil (for individual replicates), 15.5%-21.9% of the adsorbed radioactivity was desorbed from the sandy loam soil, <0.1%-0.2% of the adsorbed radioactivity was desorbed from the silty clay loam soil, and 40.6%-41.5% of the adsorbed radioactivity was desorbed from the sand soil (Table 18, p. 43).

Material balances were 96.1%-105.2% for the silt loam soil (for individual replicates across all application levels), 92.6%-100.2% for the sandy loam soil, 96.3%-104.9% for the silty clay loam soil and 89.1%-100.7% for the sand soil (Table 20, p. 45; Appendices II-V, pp. 55-58).

COMMENTS

1. Desorption of the test compound was studied at only a single application rate (5.0 $\mu\text{g/mL}$), precluding the calculation of valid desorption coefficients. The desorption study should be conducted using the test systems (at four concentrations) from the adsorption study, with desorption coefficients determined in a manner similar to that used for the determination of adsorption coefficients.
2. The study authors did not state whether one of the soils used in the study was the same as the soil used in the aerobic soil metabolism study.
3. Method detection limits were not reported. Method detection limits should be reported to assure the adequacy of the method for the determination of the test compound.
4. 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 (Appendix VI, p. 59) were based on K_{oc} values (linear adsorption isotherms) associated with the adsorption phase of the experiment; these class determinations were not reported by the reviewer. While K_{oc} is useful in determining which soil components (organic vs. mineral) have the greatest effects on pesticide mobility, the level of organic matter in a system varies with time of sampling and, thus, may lead to different results with regard to the mobility class of the pesticide. It is preferred that the reported mobility class be based on K_{ads} values.

5. This study was submitted in partial fulfillment of EPA data requirements on soil mobility for metsulfuron methyl and its degradates. The study authors stated that additional studies on the soil mobility of metsulfuron methyl and the principal degradates from the phenyl moiety, saccharin and sulfonamide, were previously conducted (pp. 11, 25).

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