IDACON + VULCAN

DATA EVALUATION RECORD

STUDY IDENTIFICATION:

Banerji, S. K., Piontek, K. and O'Connor, J. T. Pentachlorophenol adsorption on soils and its potential for migration into ground water. In: Hazardous and Industrial Solid Waste Testing and Disposal, Vol. 6. ASTM STP 933. D. Lorenzen, R. A. Conway, L. P. Jackson, C. L. Perket, A. Hamza, and W. J. Lacy, Eds. American Society for Testing and Materials. 1986. pp 120-139.

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TYPE OF STUDY: Leaching/Adsorption/Desorption (163-1)

CONCLUSIONS:

EFGWB concludes that this study does not fully satisfy the 163-1 data requirements and can only be considered supplemental at this time. Before this study can be accepted as satisfying the data requirements the below points need to be adequately addressed.

This study establishes that the adsorption of pentachlorophenol is inversely related to soil pH. At low soil pHs it is moderately to highly adsorbed to soil. At high soil pHs, especially in low organic matter soil, it is only weakly adsorbed. It is possible that pentachlorophenol could move into ground water in highly alkaline soils. EFGWB recommends that a batch equilibrium or soil column study be conducted with pentachlorophenol using a highly alkaline soil (pH 8-9) with low organic matter. Also, since pentachlorophenol readily desorbs, it would be slowly released when water of a lower pentachlorophenol content passes through the soil.

1. Only one soil type was used. A 163-1 study involving a pesticide whose use is not limited to one specific soil type needs to be conducted with a minimum of four different soil types, such as sand (agricultural), sandy loam, silt loam, and clay loam or clay. Even though two different horizons of the silt soil were used, leaching/adsorption/desorption studies using the other soil types will have to be conducted. The submitted study by Melancon et al. (MRID 409241-03) will suffice for the sandy soil study using the parent compound. One of the soils should have an organic matter content of one percent or less, with a sand or sandy

loam soil being preferred.

2. No information was furnished on the leaching/ adsorption/ desorption of pentachlorophenol degradates. An aerobic soil metabolism study (162-1) should be conducted in order to identify what pentachlorophenol degrades into in the soil environment. Using that information, EFGWB would prefer that leaching/ adsorption/ desorption studies involving the degradates be conducted using at least four different soil types as described above. Alternately, aged column studies could be run to determine mobility of pentachlorophenol degradates.

3. The Pentachlorophenol Task Force is reminded that FIFRA requires that the registrant possess or have access to the raw data used in or generated by studies.

MATERIALS AND METHODS:

Two horizons of a Boone County, Missouri Coppock series (fine-silty-mixed, mesic mollic ochraqualfs) were used. One was the surface horizon (0-18 cm) and the other was the 84-120 cm horizon. The two horizons were significantly different in organic matter, pH, bulk density, and cation exchange capacity (Table 1).

Carbon-14 labelled pentachlorophenol (specific activity 10.6 mCi/mmol, 98+% purity) was used in conjunction with purified grade (99+%) pentachlorophenol. Both materials were dissolved in 0.1N NaOH. The scintillation cocktail used was Aquasol-2.

Batch adsorption experiments were conducted by combining 14 g of soil with 140 ml of pentachlorophenol solution in 150 ml bottles. Seven different pentachlorophenol concentrations were used. Two controls were run, one with pentachlorophenol solution but no soil and one with soil and nonradiolabeled pentachlorophenol solution. The bottles were placed on a rotary shaker and shaken until equilibrium was reached (as determined in kinetic studies). Aliquots from each bottle were then centrifuged, supernatant aliquots added to Aquasol-2 scintillation cocktail, and then the supernatant pentachlorophenol concentration determined by liquid scintillation counting.

Effects of soil suspension pH, soil organic matter, and ionic strength were determined for each soil profile by running batch adsorption experiments varying those parameters. The reversibility of pentachlorophenol adsorption was determined by conducting the standard batch adsorption experiment, centrifuging the entire sample bottle to retain the soil, discarding the supernatant, adding 140 ml deionized water, and then mixing for 72 hrs. Two desorptions were done using water, and a final desorption was done using 2-propanol.

REPORTED RESULTS:

The Freundlich adsorption isotherms showed that the deeper soil profile adsorbed pentachlorophenol more (Kd 8.2, Koc 117) than did the surface soil (Kd 5.2, Koc 32.2). This was unexpected because the surface soil contained about three times more organic matter than did the subsurface profile. It was determined that pH had a greater influence on the binding capacities of the two soil profiles than did organic matter. The surface horizon Kds at pHs 5.8 and 7.5 were 8.3 and 2.0, respectively (Fig. 5). The Kocs were 66.7 and 7.8, respectively (Table 2). The subsurface horizon Kds at pHs 4.2 and 6.6 were 18.0 and 1.3, respectively (Fig. 5). The Kocs were 117 and 16.7, respectively (Table 2). Ionic strength was not found to exert a significant effect on adsorption of pentachlorophenol by soil.

Pentachlorophenol readily desorbed from the surface soil. An average of 84% of the adsorbed pentachlorophenol was desorbed by the three washings, with the majority removed by the first water wash (Table 4). The desorption Kds of the first and second water washes, and the 2-propanol wash were 7.8, 7.3, and 7, respectively.

DISCUSSION:

This is a very thorough study of the absorption/desorption of parent pentachlorophenol at different pHs in two horizons of a silt soil. The conduction of like studies using the parent compound in two more soil types, and adsorption/desorption or aged column studies of the pentachlorophenol degradates using four different soil types, would result in a very complete picture of the leaching/ adsorption/ desorption of pentachlorophenol and its degradates in soil.

EFGWB notes that the intent of this study was publication in a scientific journal, not to satisfy EPA leaching/ adsorption/ desorption study requirements. For instance, one requirement is that Kd values be calculated and sample calculations be furnished. Kd values were not furnished in the study. However, the EFGWB reviewer calculated them from data present in the study.