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DATA EVALUATION REVIEW 4

I. Study Type: Metabolism, Aerobic Soil (162-1) and Anaerobic Soil (162-2)

II. Citation:

Study 1) Stumpf, K. **Hoe 039866 - ^{14}C, Degradation in Different Soils Under Aerobic and Anaerobic Conditions at an Application Rate of 1.6 mg/kg.** performed by Hoechst AG, Frankfort am Main, Federal Republic of Germany, submitted by Hoechst Celanese Corporation, Somerville, NJ, USA. dated 5/17/89. Received EPA 12/12/89 under MRID # 413231-19.

Study 2) Stumpf, K. **Hoe 061517 - ^{14}C, Metabolite of Hoe 039866 Degradation in a Sandy Loam Soil under Aerobic Conditions at Application Rates of 0.5 and 1.0 mg/kg.** performed by Hoechst AG, Frankfort am Main, Federal Republic of Germany, submitted by Hoechst Celanese Corporation, Somerville, NJ, USA. dated 3/20/89. Received EPA 12/12/89 under MRID # 413231-18.

III. Reviewer:

Typed Name: E. Brinson Conerly
Title: Chemist, Review Section 2
Organization: EFGWB/EFED/OPP

E.B. Conerly 5/10/90

IV. Conclusions:

V. Materials and Methods:

Study 1

test material -- 3,4-^{14}C-glufosinate ammonium, applied at a rate of 1.6 mg/kg (1.6 ppm)

test soils -- sandy loam, silt loam, loamy sand, marshy soil, and peat soil taken from the upper 10 - 15 cm of agricultural fields, stored with a "cover crop" of chickweed, exposed to artificial sunlight and irrigated when required. Before use they were sieved (<2 mm) and adjusted to approximately 75% of 1/3 bar.

incubation protocol

aerobic -- in the dark at 21 ± 2° C; both open and closed systems were used. In the closed system, CO_2 was trapped in 2-aminoethanol/2-methoxyethanol (3/7 vv), and other volatiles were trapped in 2-methoxyethanol. Vessels were sampled at days 0, 1,4, 7, 14, 20, 29, 60, 90, 120 days.

anaerobic -- sandy loam incubated for 7 days aerobically, then flooded with water and purged with nitrogen. Although redox potential and oxygen content did not reach their minimum values until day 11, CO_2 evolution was suppressed, and the conditions were considered to be anaerobic from the conversion point [day 7] on. Vessels were sampled at 11, 26, 46, and 71 days after conversion

soil extraction -- with hot water (60 - 70° C)

analytical methods

HPLC -- lod 0.008 ppm
GC/MS -- on acetylated/methylated derivatives
GC/FPD
combustion followed by LSC

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Study 2 -- as above, except as noted

test material -- HOE 061517 (3-^{14}C-3-methylphosphinico-propionic acid), the main metabolite of HOE 039866, applied at 0.5 and 1.0 ppm
test soil -- sandy loam as above
sampling protocol -- days 0, 1, 3, 7, 21, 30, 63, 90, and 120

Study 3 -- supplemental material to a previously submitted study

VI. Study Author's Results and/or Conclusions:

Study 1
The objective of study 1 was to establish degradation rate at the normal application rate since prior studies have showed concentration effects. E.g., at 2.3 mg/kg, the half life was 5 - 10 days; above 5 ppm it was 15 - 30 days.

RESULTS
Aerobic
DT-50 values of 13 - 22 days were found for HOE 061517, and DT-50 of approximately 20 days for HOE 064619. HOE 039866 was quantitatively extractable from the sandy soils, but less so from silt, peat, and marsh.

Unextractable residues increased to 30 - 43% then decreased slowly.

The only volatile degradate detected in quantity was CO_2, although trace amounts of radioactivity were seen at 0.1 - 1.0% of applied in some day 43 [sic] samples.

In open vessels, recovery was 50 - 75% at day 120, but was 80 -90% in the closed vessels.

Anaerobic
Total mineralization was suppressed. Only 3.4% of $^{14}CO_2$ was formed. The disappearance time of the active ingredient was rapid with a DT-50 of 5 - 10 days, but both main metabolites were degraded very slowly. 69 - 82% of applied radiocarbon was still extractable at the end of the study (78 days after application).

CONCLUSIONS

The degradation of the herbicide glufosinate-ammonium is very fast in microbially active soils under aerobic conditions when the active ingredient is added at rates occurring in agricultural practice.

The aerobic degradation occurred *via* oxidative deamination and decarboxylation, forming HOE 061517 and HOE 064619. The metabolites too undergo rapid degradation to CO_2 and smaller molecules, and are incorporated into the microbial biomass of the soil, or adsorbed strongly to the soil.

HOE 039866 is degraded rapidly under aerobic and anaerobic conditions. It is therefore unlikely that, under normal agricultural conditions, either the active ingredient or metabolites will accumulate in the upper soil layer. The risk of transport to deeper soil layers is minimized and ground water contamination will not occur.

The decrease in bound residues after an initial increase means that these residues can also be degraded. The low level of extractable compounds at the end of the study indicates the rapid degradation of parent and metabolites.

Degradation is slower in the closed systems, and the rate of degradation and CO_2 evolution is similar for open systems.

Study 2
The objective of the study was to determine the DT-50 and DT-90 values for HOE 061517 independent of HOE 039866.

RESULTS
Only one degradation product could be detected, HOE 064619, representing maximum of 38% (at 0.5 ppm) and 31% (at 1.0 ppm) of the applied material after 21 days. From the decline curve the metabolite has a DT-50 of 20 -30 days.

CONCLUSIONS
The degradation of both HOE 061517 and HOE 064619 is fast, and there is no risk of accumulation of these metabolites from the use of HOE 039866. The risk of transport to deeper soil layers is minimal.

VII. Reviewer's Comments:

Study 1

Additional information on the soils is needed. The country of origin of the soils is not given. The silt loam (Mississippi 2) is probably from the U.S.A.

The report refers to DT-50 and DT-90, rather than the more usual **half-life**. This terminology avoids any implications about kinetics of the system.

Although this does not invalidate the study, the method of soil extraction is not typical of studies reviewed by EFGWB. Hot water extraction is not exhaustive, and some of the unrecovered residues from this procedure may yield to another relatively mild technique. Some of this "bound" material is apparently bioavailable and may also be taken up by crops.

Study 2 -- The above comments apply.

VIII. CBI Information Addendum: attached