US EPA ARCHIVE DOCUMENT

(UNDATED)

DATA EVALUATION RECORD

STUDY 1

---CHEM 083301 Grotan

§161-1

FORMULATION--00--ACTIVE INGREDIENT

---STUDY ID 43181001

Cohen, S.P. 1994. Hexahydro-1,3,5-tris (2-hydroxyethyl)-s-triazine (Triazine): Hydrolysis of Triazine in buffered aqueous solutions. PERL Study No. ME 9300156. Unpublished study performed by Pittsburgh Environmental Research Laboratory, Inc., Pittsburgh, PA; and submitted by Triazine Joint Venture, c/o Buckman Laboratories International, Inc., Memphis, TN.

---DIRECT REVIEW TIME = 33

---REVIEWED BY: M. Dillman

TITLE: Staff Scientist

EDITED BY: K. Ferguson
C. Cooke

TITLE: Task Leader
Staff Scientist

APPROVED BY: W. Spangler

TITLE: Project Manager

ORG: Dynamac Corporation
Rockville, MD
TEL: 301-417-9800

---APPROVED BY: S. Termes

TITLE: Chemist
ORG: EFGWB/EFED/OPP
TEL: 703-305-5243

SIGNATURE:

CONCLUSIONS:

Degradation - Hydrolysis

1.This study can be used to towards the fulfillment of data requirements.

2.Hexahydro-1,3,5-tris(2-hydroxyethyl)-s-triazine (Grotan), at approximately 34 ug/mL, hydrolyzed with an observed initial half-life of approximately 2 days at pH 5 in sterile aqueous buffered

1

solutions that had been treated with a mixture (1:2) of triazine ring-labeled [2,4,6-^{14}C]Grotan and unlabeled technical grade Grotan (Busan 1060; purity 78.2%), and incubated at 25.0 C in the dark for 30 days. The only non-volatile [^{14}C]degradate identified was formaldehyde.

The degradation of Grotan to formaldehyde did not follow first-order kinetics at pH 7 and pH 9 in sterile aqueous buffered solutions under similar incubation conditions, but instead formed an equilibrium with formaldehyde. In the pH 7 solution, [^{14}C]Grotan decreased to 68.4% of the applied at 30 days posttreatment. In the pH 9 solution, [^{14}C]Grotan was 79.4-84.2% of the applied at 1 through 30 days posttreatment.

3.This study is acceptable and partially fulfills EPA Data Requirements for Registering Pesticides by providing information on the hydrolysis of triazine ring-labeled [2,4,6-^{14}C]Grotan [hexahydro-1,3,5-tris(2-hydroxyethyl)-s-triazine] in aqueous buffered solutions at pH 5, 7, and 9.

4.No additional information on the hydrolysis of triazine ring-labeled [^{14}C]Grotan to formaldehyde is needed at this time. Information is needed on the fate of other portions of the hexahydro-1,3,5-tris(2-hydroxyethyl)-s-triazine molecule.

METHODOLOGY:

A treatment solution of hexahydro-1,3,5-tris(2-hydroxyethyl)-s-triazine (Grotan) was prepared by dissolving triazine ring-labeled [2,4,6-^{14}C]Grotan (Wizard Laboratories) and unlabeled technical grade Grotan (Busan 1060; purity 78.2%, Buckman Laboratories) in an aqueous solution of ammonium sulfate (0.25 M, pH 7); the ratio of labeled to unlabeled test substance was "approximately" 5 mg:9.98 mg, the average radiopurity of the treatment solution was 85.2%, and the average specific activity was 4.90 uCi/mg. The solution was filter-sterilized (0.22 um), and aliquots were added aseptically to sterilized borosilicate glass bottles containing filter-sterilized (0.20 um) aqueous buffer solutions that had been adjusted to pH 5 (0.025 M acetate), pH 7 (0.01 M phosphate), or pH 9 (0.025 M borate). Duplicate samples were prepared for each buffer solution. The treated solutions were mixed by swirling for 1 minute. Single aliquots (7 mL) of each treated solution were aseptically removed for analysis as day-0 samples; the average concentrations of Grotan in the pH 5, 7, and 9 buffer solutions were 32.23, 32.71, and 33.76 ug/mL, respectively (96.7-99.7% of the total [^{14}C]residues). The bottles containing the remaining treated buffer solutions were stoppered with PTFE-lined caps and wrapped in aluminum foil, and the solutions were incubated in the dark at 25.0 $\pm$ 1.0 C. Single aliquots (7 mL) of each solution were removed for analysis at 1, 2, 3, 7, 14, and 30 days posttreatment. No attempt was made to collect volatiles.

An aliquot of each sample was analyzed for pH, and duplicate aliquots were analyzed for total radioactivity using LSC. Within approximately 1 hour of collection, additional aliquots of the sample solutions were analyzed directly by isocratic HPLC using a Bio-Rad Aminex HPX-72S

column eluted with aqueous ammonium sulfate (0.25 M, pH 7); the column was equipped with UV (220 nm) and radioactive flow detection. HPLC column recoveries were >90%, and the detection limit using the radioactive flow detector was 0.05 ug/mL. Unlabeled reference standards of Grotan and the degradates formaldehyde, ethanolamine, and formic acid, and a radiolabeled reference standard of formaldehyde were cochromatographed with the samples and/or analyzed externally, and tentative identifications of [^{14}C]compounds were made by comparison of retention times. For confirmation of the identity of the degradate formaldehyde, an aliquot of each sample was analyzed directly by isocratic HPLC using a Bio-Rad Aminex HPX-87H column eluted with 0.005 M sulfuric acid:acetonitrile (95:5, v:v), and equipped with UV (219 nm) and radioactive flow detection. It was reported that, under these conditions, formaldehyde and formic acid have approximately the same retention time [page 16].

DATA SUMMARY:

Hexahydro-1,3,5-tris(2-hydroxyethyl)-s-triazine (Grotan), at approximately 34 ug/mL, hydrolyzed with a registrant-calculated half-life of 3.05 days and an observed initial half-life (through 3 days posttreatment) of approximately 2 days at pH 5 in sterile aqueous buffered solutions that had been treated with a mixture (1:2; average radiopurity 85.2%) of triazine ring-labeled [2,4,6-^{14}C]Grotan and unlabeled technical grade Grotan (Busan 1060; purity 78.2%), and incubated at 25.0 $\pm$ 1.0 C in the dark for 30 days (Figure 7 and Table VI). The only non-volatile [^{14}C]degradate identified was

formaldehyde.

The degradation of Grotan did not follow first-order kinetics at pH 7 and pH 9 in sterile aqueous buffered solutions under similar incubation conditions, but instead formed an equilibrium with formaldehyde (Tables VIII and X, respectively).

In the pH 5 solution, [^{14}C]Grotan decreased from 97.4-97.6% of the applied immediately posttreatment to 61.4-62.1% at 1 day, 49.6-50.0% at 2 days, 35.7-38.6% at 3 days, 13.8-14.7% at 7 days, 3.6-3.8% at 14 days, and <0.2% at 30 days (Table VI). [^{14}C]Formaldehyde increased from 2.4-2.6% of the applied immediately posttreatment to 50.5-50.6% at 2 days and 101% at 30 days. Material balances were 95.8-102% of the applied throughout the study; the pH of the solutions ranged from 4.98 to 5.03 (Table XII).

In the pH 7 solution, [^{14}C]Grotan decreased from 96.3-97.2% of the applied immediately posttreatment to 77.7-81.2% at 1 through 7 days, 75.6% at 14 days, and 68.4% at 30 days (Table VIII). [^{14}C]Formaldehyde increased from 2.8-3.7% of the applied immediately posttreatment to 19.0-23.0% at 1 through 7 days, 24.7% at 14 days, and 31.0% at 30 days. Material balances (excluding contaminated sample results) were 99.0-101% of the applied throughout the study; the pH of the solutions ranged from 6.98 to 7.02 (Table XII).

3

In the pH 9 solution, [^{14}C]Grotan decreased from 97.4-98.1% of the applied immediately posttreatment to 79.4-84.2% at 1 through 30 days (Table X). [^{14}C]Formaldehyde increased from 1.9-2.6% of the applied immediately posttreatment to 17.6-20.7% at 1 through 30 days. Material balances were 99.6-103% of the applied throughout the study; the pH of the solutions ranged from 8.97 to 9.01 (Table XII).

COMMENTS:

1. Because of the complexity of the Grotan molecule, the position of the radiolabel (triazine ring-labeled [2,4,6-^{14}C]Grotan) was adequate to mark only some of the possible degradates of Grotan. The formation of least one of the possible degradates mentioned in the study, ethanolamine, would have resulted in an unlabeled compound, and the study author was very specific in stating that formaldehyde was the only radiolabeled degradate isolated. Although the HPLC columns were equipped with UV detection, this equipment was apparently used primarily to detect nonradiolabeled standards; no data from the UV detectors were provided.

2. Both the radiolabeled and nonlabeled Grotan that were used to make the treatment solution contained significant amounts of formaldehyde prior to the start of the experiment. Since it was established that Grotan degraded to and formed an equilibrium with formaldehyde, it is possible that the presence of formaldehyde in the test solution at the initiation of the study may have affected the degradation rate of Grotan.

3. The radiolabeled test substance employed in this study was not analytical grade or purer; the average radiopurity of the treatment solution was only 85.2%. According to the study author, "the labile chemical nature of the test substance makes improvement on this radiopurity very difficult" [page 72]; apparently, no attempt was made to repurify the test substance prior to its use in the hydrolysis study.

4. The sterility of each buffer solution was established prior to treatment, and at 14 and 30 days posttreatment by spreading aliquots of the solutions onto Plate Count Agar and Blood Agar. With the exception of one of the two pH 7 samples in which microorganisms were detected at 14 and 30 days, sterility was maintained in all samples throughout the study. The contamination affected the study results: material balances in the contaminated sample were acceptable through 7 days posttreatment, but at 14 and 30 days decreased to 75.7 and 60.4% of the applied, respectively. Consequently, data obtained from the 14- and 30-day sampling intervals were not reported in the data summary of this review.

5. In preliminary hydrolysis studies conducted with Grotan at each pH, no significant volatilization occurred, and the test material did not significantly adsorb to the unsilanized glassware.