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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 7 - 1993

188AAA
CASWELL FILE

010306

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

MEMORANDUM

SUBJECT: Oxyfluorfen; Pharmacokinetic Metabolism Study in Rats;
Submitted by Rohm and Haas Company to Partially Fulfill
the Guideline Requirement 85-1: General Rat Metabolism
Study; Reregistration Case #: 2490; ID #: 111601-000707

Tox.Chem No.: 188AAA
MRID No.: 42374201
DP Barcode No.: D180875
Submission No.: S422271

TO: Bruce Sidwell, PM #53
Reregistration Branch
Special Review and Reregistration Division (H7508W)

FROM: William Dykstra, Ph.D., Toxicologist *William Dykstra*
Review Section I *9/30/92*
Toxicology Branch I
Health Effects Division (H7509C)

THRU: Roger Gardner, Section Head, Toxicologist
Review Section I
Toxicology Branch I *Roger Gardner 5-21-93*
Health Effects Division (H7509C) *KP 5/24/93*

ACTION REQUESTED: In response to a Phase 4 DCI, the Registrant, Rohm and Haas Company, has submitted a "Pharmacokinetic Study in Rats" in partial fulfillment for the requirement of a rat general metabolism study (Guideline Study No. 85-1). Toxicology Branch has been requested to review the study and determine if it supports reregistration.

CONCLUSIONS: The "Pharmacokinetic Study in Rats" is acceptable to partially fulfill the rat general metabolism study requirement.

Groups of 5/sex/dose Sprague-Dawley rats were orally dosed once with C¹⁴-oxyfluorfen at three different doses: 4 mg/kg, 320 mg/kg, and, following pretreatment for 2 weeks with 40 ppm Goal Technical, were "pulse" dosed with 4 mg/kg C¹⁴-oxyfluorfen. Excreta were collected up to 7 days and analyzed for radiolabel. Groups of rats were sacrificed at 6 hours and 7 days and plasma (whole blood), selected tissues, and carcasses were collected and analyzed for C¹⁴-residues. In addition, groups of rats were serially bled over the 7 day period and plasma and whole blood were analyzed for C¹⁴-label.

The total recovery of radioactivity was 97-99, 84-91, and 85-86% for the low-, high-, and pulse-dose groups, respectively. Most (82-98%) of the radioactivity was excreted within 2 days and found predominately in the feces. In contrast to males, the urine of females contained 3-4 times more radiolabel than the urine of males. After 7 days only 0.1-1.4% of the radiolabel remained in the carcasses of males and females of all dose groups. Elimination of the radiolabel from the plasma was biphasic in both sexes of the low- and high-dose groups (rapid phase = 9-13 hours; slow phase = 26-32 hours). Radiolabel was higher in all tissues at the 6 hour period than at the 7 day sampling period. At the low- and high-dose and pulse-dose, highest concentrations were found in fat, liver, adrenal, thyroid, kidney, lung and ovaries. Pretreatment with 40 ppm for 2 weeks did not have a remarkable effect on tissue distribution of radiolabel.

Reviewed by: William Dykstra, Ph.D. Toxicologist
Review Section I, Tox. Branch I
Secondary Reviewer: Roger Gardner, Section Head
Review Section I, Tox Branch I

William Dykstra

9/30/92

Roger Gardner

5-21-93

DATA EVALUATION REPORT

STUDY TYPE: 85-1; Rat General Metabolism
TOX. CHEM NO: 188AAA
MRID NO.: 42374201
TEST MATERIAL: C¹⁴-Oxyfluorfen
SYNONYMS: Goal Herbicide
STUDY NUMBER: Report No. 90R-193
SPONSOR: Rohm and Haas Company
TESTING FACILITY: Toxicology Department, Rohm and Haas Co.
TITLE OF REPORT: C¹⁴-Oxyfluorfen (Goal Herbicide):
Pharmacokinetic Study in Rats
AUTHOR(S): L.J. DiDonato & G.A. Hazleton
REPORT ISSUED: May 26, 1992

CONCLUSION: Groups of 5/sex/dose Sprague-Dawley rats were orally dosed once with C¹⁴-oxyfluorfen at three different doses: 4 mg/kg, 320 mg/kg, and, following pretreatment for 2 weeks with 40 ppm Goal Technical, were "pulse" dosed with 4 mg/kg C¹⁴-oxyfluorfen. Excreta were collected up to 7 days and analyzed for radiolabel. Groups of rats were sacrificed at 6 hours and 7 days and plasma (whole blood), selected tissues, and carcasses were collected and analyzed for C¹⁴-residues. In addition, groups of rats were serially bled over the 7 day period and plasma and whole blood were analyzed for C¹⁴-label.

The total recovery of radioactivity was 97-99, 84-91, and 85-86% for the low-, high-, and pulse-dose groups, respectively. Most (82-98%) of the radioactivity was excreted within 2 days and found predominately in the feces. In contrast to males, the urine of females contained 3-4 times more radiolabel than the urine of males. After 7 days only 0.1-1.4% of the radiolabel remained in

the carcasses of males and females of all dose groups. Elimination of the radiolabel from the plasma was biphasic in both sexes of the low- and high-dose groups (rapid phase = 9-13 hours; slow phase = 26-32 hours). Radiolabel was higher in all tissues at the 6 hour period than at the 7 day sampling period. At the low- and high-dose and pulse-dose, highest concentrations were found in fat, liver, adrenal, thyroid, kidney, lung and ovaries. Pretreatment with 40 ppm for 2 weeks did not have a remarkable effect on tissue distribution of radiolabel.

Core Classification:

Acceptable

REVIEW: Pharmacokinetic Study in Rats (Toxicology Department, Rohm and Haas Co., Report No. 90R-193, May 26, 1992)

Test Material: The following is a list of compounds that were used in the dosing aspect of the study:

1. C¹⁴-Oxyfluorfen; Lot No. 602.0015; Specific Activity 9.12 mCi/g; 92.9% a.i.; Tox. Dept. Sample No. 90-122
2. C¹³-Oxyfluorfen; Lot No. MWS-15-92; 94.9% a.i.; Tox. Dept. Sample No. 90-128
3. Nonradiolabeled oxyfluorfen; Lot No. RPO 8674FP; 99.4% a.i.; Tox. Dept. Sample No. 90-129
4. Nonradiolabeled Goal Technical Herbicide; Lot No. 2-0956; 71.4% a.i.; Tox. Dept. Sample No. 90-001

Methods: The absorption, distribution and excretion of C¹⁴-oxyfluorfen was determined in male and female Crl:CD(Sprague-Dawley)BR rats (approximately 125-150 grams) (Charles River Kingston; Stone Ridge, NY). The experimental design for this study included three different treatments of C¹⁴-oxyfluorfen: a low dose (4 mg/kg), a high dose (320 mg/kg) and a pulse-dose (dietary treatment with 40 ppm (a.i.) nonradiolabeled Goal Technical Herbicide for 2 weeks followed by a 4 mg/kg radiolabeled dose). Material balance, excretion, plasma/whole blood and tissue data were collected from groups of rats administered either low-, high-, or pulse-doses of C¹⁴-oxyfluorfen. A detailed description of the experimental design is shown below:

GP	Dose				Time After C ¹⁴ -oxyfluorfen										
	Sx	Rte	mg/ kg	n	Ohr	Administration									
						1	3	6	10	1 d	2	3	4	7 ^b	
A	M	Or.	4	5	E						E	E	E	E	E,K
B	F	Or.	4	5	E						E	E	E	E	E,K
C	M	Or.	4	4		B	B	B	B	B	B	B	B	B	B,K*
D	F	Or.	4	4		B	B	B	B	B	B	B	B	B	B,K*
E	M	Or.	4	4	E			E,K ^d							
F	F	Or.	4	4	E			E,K ^d							
G	M	Or.	320	5	E						E	E	E	E	E,K
H	F	Or.	320	5	E						E	E	E	E	E,K
I	M	Or.	320	4		B	B	B	B	B	B	B	B	B	B,K*
J	F	Or.	320	4		B	B	B	B	B	B	B	B	B	B,K*
K	M	Or.	320	4	E			E,K ^d							
L	F	Or.	320	4	E			E,K ^d							
M ^a	M	Pl.	4	5	E						E	E	E	E	E,K
N ^a	F	Pl.	4	5	E						E	E	E	E	E,K

Footnotes for Study Design

E: Collect urine, urine funnel wash, and feces over dry ice for C¹⁴-analysis; store remaining excreta samples frozen for metabolite identification and analysis.

B: Collect whole blood and plasma for C₁₄-analysis.

K: Kill and collect whole blood, liver, fat, kidney, bone marrow, heart, lungs, brain, testes (males), ovaries (females), muscle, spleen, adrenals, thyroids, and remaining carcass for C₁₄-analysis. Store remaining samples frozen for possible metabolite identification and analysis.

K*: After blood collection, animals were killed and carcasses were stored frozen.

a: These animals received 40 ppm (ai) nonradiolabeled Goal Technical Herbicide in the diet for two weeks prior to receiving a single pulse dose (oral gavage) of 4 mg/kg C₁₄-oxyfluorfen.

b: The 7 day excreta collection was a pooled sample consisting of 5, 6, and 7 day excreta.

c: All animals were dosed orally by gavage at 5 ml/kg (corn oil).

d: Animals in Groups E, F, K, and L were killed when peak C¹⁴-concentrations occurred in plasma, pending the results of Groups C, D, I, and J. Whole blood and other tissues (described in item "K") plus excreta were collected and analyzed for C₁₄-label, and then stored frozen for possible identification and analysis.

The C¹⁴-metabolite analysis will be conducted by the Residue Metabolism and Environmental Fate Department of the Rohm and Haas Company and will be presented in a separate report.

The dose solution (0.8 mg/ml) for the low-, and pulse-dose groups (Groups A, B, C, D, E, F, M, and N) was prepared by dissolving 1 part C¹⁴-oxyfluorfen and 1 part C¹³-oxyfluorfen in acetone. Subsequently, the acetone was evaporated under nitrogen, and a known volume of corn oil was added.

The dose solution (64 mg/ml) for the high-dose groups (Groups G, H, I, J, K, and L) was prepared by dissolving 1 part C¹⁴-oxyfluorfen and 5 parts C¹³-oxyfluorfen and 4 parts nonradiolabeled analytically pure oxyfluorfen in acetone. Subsequently, the acetone was evaporated and the correct amount of corn oil was added. Both dosing solutions were warmed to 37° C prior to dosing. The 0.8 mg/ml and 64 mg/ml dose solutions were used to dose the 4 mg/kg and 320 mg/kg dose groups, respectively.

The diet, used for the two-week pretreatment of pulse-dose Groups M and N, was prepared by dissolving nonradioactive Goal Technical Herbicide (71.4% a.i.) in acetone and mixing with a small amount of feed. This premix was then brought to an appropriate weight with additional untreated feed. The diet was analyzed for concentration and was found to be 96.7% of the target dietary concentration of 40 ppm a.i. Over the 2 week feeding period the average compound intake for males and females was 3-5 mg a.i. per kg per day.

* C¹³-oxyfluorfen was included in the dose preparation to assist in the metabolite identification phase of the project. The results of the metabolite identification and analysis will be submitted as an addendum to this pharmacokinetic study.

The C¹⁴-oxyfluorfen dose solutions were administered orally by gavage (5 ml/kg) to 6 groups of rats (males, Groups A, C, E; and females, Groups B, D, F) at 4 mg/kg and 6 groups of rats (males, G, I, K; and females, Groups H, J, L) at 320 mg/kg. Two additional groups of rats (males Group M; and females Group N) received nonradiolabeled Goal Technical in the diet at 40 ppm for 2 weeks prior to receiving a "pulse" oral dose (5 ml/kg) of 4 mg/kg C¹⁴-oxyfluorfen.

For Groups A, B, G, H, M, and N, urine and feces were collected at intervals up to 7 days after dose administration and analyzed for C¹⁴-label. All rats in these groups were killed after 7 days and whole blood (plasma), liver, fat, kidney, bone marrow, heart, lungs, brain, testes (males), ovaries (female), muscle, spleen, adrenals, and thyroids were removed and analyzed for C¹⁴-label. In addition, the remaining carcasses were collected for C¹⁴-analysis. For Groups C, D, I, and J, whole blood and plasma were collected at intervals up to and including 7 days after dose administration and analyzed for C¹⁴-label. All rats in these groups were killed after 7 days and tissues and carcass were discarded. Rats in Groups E, F, K, and L were killed at 6 hours after dose administration when plasma C¹⁴-concentrations were near or at peak levels. In these animals, tissues (previously described) and remaining carcasses were collected and analyzed for C¹⁴-label.

The half-lives of elimination of C¹⁴-label from whole blood and plasma were calculated using the equation: half-life ($t_{1/2} = \ln 2/k_{el}$). The rate constants of elimination (k_{el}), were designated α (for rapid phase) and β (for slow phase), and were determined by linear regression analysis on time course data (i.e., \ln (ppm) plotted against time).

RESULTS: There were no treatment-related deaths or toxic signs during the study. The table below shows the material balance for recovery of C¹⁴-label

7-Day Recovery of C¹⁴-Label from Rats Given a Single Oral Dose or Pulse-Dose of C¹⁴-Oxyfluorfen

Dose (mg/kg)	4 M	4 F	320 M	320 F	4 M Pl	4 F Pl
Urine	10.27	24.71	5.11	25.11	9.94	18.61
UFW	0.96	2.09	0.76	1.90	0.77	1.38
Feces	87.00	68.63	77.49	63.31	71.37	63.59
Cage Wash	0.07	0.08	0.10	0.12	0.07	0.10
Whole Blood	0.07	0.06	0.02	0.02	0.04	0.01
Tissues	0.45	0.40	0.18	0.12	0.77	0.43
Carcass	0.76	0.70	0.68	0.45	1.38	0.50
Total	99.58	96.71	84.34	91.02	85.40	86.10

* values represent percent of administered dose

UFW = Urine Funnel Wash

Pl = pulse-dose

The overall recovery of radioactivity in both low-dose sexes were comparable (99.6% and 96.7% for males and females, respectively) with the most recovery in the excreta after 7 days (feces, urine and UFW). The overall recovery in the high-dose was 84.3% in male and 91.0% in females with the C¹⁴-label located in the excreta. There was only small amounts of radiolabel in the tissues or carcass (0.12-0.45% in tissues and 0.45-0.76% in carcasses). Similarly, in the pulse-dose, recovery in males and females was 85.4% and 86.1% and most of the radiolabel was found in the excreta, with minor amounts found in the tissues collected (.4-.8%) and remaining carcass (0.5-1.5%). In both the low- and high-dose, and pulse-dose groups, 82-95% of the excreted dose was eliminated in the first 2 days.

Although the data are not tabulated in the review, the report states that in the low- and high-dose groups, the highest C¹⁴-concentrations in plasma occurred at 6 and 6-24 hours, respectively, and declined thereafter. Elimination of the C¹⁴-label from the plasma was biphasic in both sexes of the low- and high-dose groups (rapid phase = 9-13 hours; slow phase = 26-32 hours). The following table from the report shows the half-lives in plasma and whole blood.

Dose (mg/kg)	Sex	$T_{1/2}$ (hr)*			
		Plasma		Whole Blood	
		Rapid phase	Slow phase	Rapid phase	Slow phase
4	M	12.5	31.9	13.9	78.9
4	F	8.5	29.2	12.3	63.0
320	M	13.1	26.1	13.9	45.9
320	F	10.0	32.4	12.3	79.4

* Half life ($t_{1/2}$) for rapid phase of elimination = $\ln 2/\alpha$
 Half life ($t_{1/2}$) for slow phase of elimination = $\ln 2/\beta$

Tissue concentrations of C^{14} -label were higher at the 6 hour sampling period than at 7 days in the low- and high-dose groups. A total of 4-6 and 3% of the administered dose was present in the tissues collected at 6 hour in the low- and high-dose groups, respectively. At the end of 7 days, 0.4-0.5 and 0.1-0.2% of the administered dose was observed in the tissues from the low- and high-dose groups, respectively. In males and females of the pulse-dose group, 0.4-0.8% of the administered dose was observed in tissues at 7 days. In the table shown below, the tissue distribution of C^{14} -label in males and females at 7 days is presented.

010306

7 Day Tissue C¹⁴-Concentration in Rats Given a Single Oral or Pulse Dose of C¹⁴-Oxyfluorfen

Dose (mg/kg)	4 M	4 F	320 M	320 F	4 M PL	4 F PL
Liver	.277	.271	7.034	4.266	.290	.225
Kidney	.174	.103	6.949	2.938	.167	.105
Heart	.021	.017	1.138	1.108	.097	.054
Lung	.136	.149	2.808	2.581	.601	.616
Testes	.022	-	0.748	-	.020	-
Ovaries	-	.157	-	6.620	-	.227
Fat	.267	.373	25.728	23.820	.820	.356
Brain	.010	.006	.396	.551	.020	.016
Muscle	.002	.000	.273	.507	.010	.001
Spleen	.022	.022	.977	.832	.039	.039
Adrenals	1.181	.340	4.550	4.923	.406	.174
Thyroid	.169	.252	3.878	2.590	.126	.071
Bone Marrow	.044	.057	0.859	.780	.029	.007

* = Values represent ppm (μg equivalent per gram wet weight tissue)

PL = pulse-dose

At the low- and high-dose and pulse-dose, highest levels were found in the adrenals, fat, ovaries, thyroid, liver, kidney and lung.

Lowest levels were found in the brain, muscle, spleen, bone marrow, heart, and testes.

It can be seen from a comparison of the low-dose with the pulse-dose that the overall distribution of C¹⁴-label in tissues was not significantly altered by pre-dosing the rats for 2 weeks with 40 ppm (a.i.) Goal Technical Herbicide in their diet.

There were signed and dated statements of Quality Assurance and Good Laboratory Practice Compliance.

Tox Chem No. 1884444

File Last Updated

Current Date 9/30/92

Study/Lab/Study #/Date _____ Material _____ Accession No. _____ EPA _____ Results: LD50, LC50, PIS, NOEL, LEL, LFL _____ TOX Category _____ CORE Grade/Doc. No. _____

85-1 (Partials)
fulfillment!
rat pharmacokinetic study
with C¹⁴ oxyfluorfen
Rothman and Hearn
Toxicology Dept.
Report No. 90R-193,
May 26, 1992

C¹⁴
oxyfluorfen

42794201

Acceptable

Groups of 5/sex/dose Sprague-Dawley rats were orally dosed once with C¹⁴-oxyfluorfen at three different doses: 4 mg/kg, 320 mg/kg, and, following pretreatment for 2 weeks with 40 ppm Ggal Technical, were "pulse" dosed with 4 mg/kg C¹⁴-oxyfluorfen. Excreta were collected up to 7 days and analyzed for radiolabel. Groups of rats were sacrificed at 6 hours and 7 days and plasma (whole blood), selected tissues, and carcasses were collected and analyzed for C¹⁴-residues. In addition, groups of rats were serially bled over the 7 day period and plasma and whole blood were analyzed for C¹⁴-label.

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423742-00

May 27, 1992

Mr. Mark Wilhite - Chemical Review Manager
Document Processing Desk (RS-2490)
Office of Pesticide Programs - H7504C
U. S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460-0001

Dear Mr. Wilhite:

Subject: .Reregistration - Chemical Number 111601
.Chemical Name - Oxyfluorfen
.Case Number 2490
.Submission of Report in Partial Fulfillment of Guideline
Requirement 85-1

Enclosed are four copies of the following report submitted in support of the reregistration of oxyfluorfen:

L. J. DiDonato and G. A. Hazelton - ¹⁴C Oxyfluorfen (GOAL Herbicide): Pharmacokinetic Study in Rats - Rohm and Haas Report No. 90R-193 - May 26, 1992 42374201

If you have any questions or require additional information, please call me at 215-592-3190.

Sincerely,

W. T. Lynch, Ph.D.
Product Registration Manager
Agricultural Chemicals Registration
and Regulatory Affairs Department

WTL/hew