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DYNAMAC
CORPORATION

ENVIRONMENTAL FATE AND EXPOSURE ASSESSMENT OF FENVALERATE

Initial Draft Report

SUMMARY OF THE CONTRIBUTION OF ALL STUDIES THAT HAVE BEEN REVIEWED TO DATE TOWARDS THE FULFILLMENT OF DATA REQUIREMENTS

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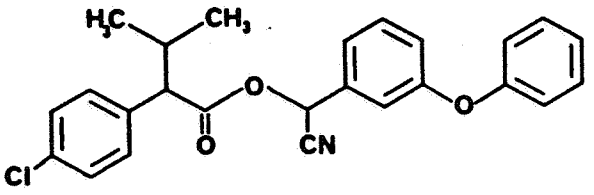
Environmental Fate and Exposure Assessment

Fenvalerate



4''-Chloro-(2'''-isopropyl)phenylaceto-2-(3'-phenoxy)phenylacetonitrile

(All isomers; SD 43775, SD 47443)

This report is based upon information contained in EPA reviews of data submitted by the registrant. It is not based on the original data.

Use Pattern

Fenvalerate is a contact insecticide registered for use on a variety of field, vegetable, and orchard crops, ornamentals, terrestrial noncrop sites, and domestic and commercial indoor and outdoor sites. Application rates range from 0.05 to 0.75 lb ai/A. Fenvalerate may be formulated with petroleum distillates. Single active ingredient formulations consist of 2.4 lb ai/gal EC, 8.6% impregnated materials, and 0.01% RTU. Fenvalerate is generally surface applied by ground equipment or aircraft. The 2.4 lb ai/gal EC is a restricted use pesticide and applicators must be certified to apply fenvalerate. Fenvalerate is highly toxic to bees.

Executive Summary

Fenvalerate (2.4 lb/gal EC), at 0.05 lb ai/A, was stable for 93.5 hours in buffered solutions (pH 5, 7, and 9) incubated in the dark at 38°C (Williams, 19??, Acc. No. 243109). In water:ethanol solutions (90:10, v:v) maintained at 38°C, fenvalerate (test substance uncharacterized) degraded with a half-life of 100 hours at pH 1.1, 570 hours at pH 7.2, and 70 hours at pH 9.1 (?, 1977, Acc. No. 096386).

Chlorophenyl-labeled [^{14}C]fenvalerate, at <1 ppm, degraded with a calculated half-life of 41 days in a distilled water solution containing xylene and a surfactant (relative amounts unspecified) that was irradiated with natural sunlight (~8 hours/day at ~5400 foot lamberts) (Fan, TIR-22-101-76; Acc. No. 096386). Following 28 days of irradiation, ~59% of the applied remained undegraded; three degradates, at ≤11.6% of the applied, were isolated but not identified. In a second study, CO group-, benzyl group-, and CN group-labeled [^{14}C]fenvalerate, at 0.05 ppm, photodegraded to SD 44607, 2-(4-chlorophenyl)isovaleric acid, and CO_2 (Mikami et al., 1980, Acc. No. ?).

Chlorophenyl ring-labeled [^{14}C]fenvalerate, at 11.9 μg/cm^2 degraded with a half-life of >28 days on sandy loam soil irradiated with either sunlight (May through October, variable temperatures) or artificial light (1760 foot lamberts, 41°C); 53 and 60%, respectively, of the applied fenvalerate remained undegraded after 28 days (Fan, TIR-22-101-76, Acc. Nos. 096386 and 097296). Phenoxyphenyl-labeled [^{14}C]fenvalerate degraded with half-life of 14-28 days on irradiated sandy loam soil (Fan, TIR-22-109-78, Acc. No. 097296). In both studies, SD 47117 was the major non-volatile degradate; small amounts of SD 52666, SD 53919, and SD 53065 were also detected. [^{14}C]-Fenvalerate (labeling site unspecified), at 0.3 lb ai/A, degraded with a half-life of 15-23 days on sandy loam soil irradiated with either natural sunlight or artificial light at 29-39°C; in the dark control, the half-life was calculated to be 144-194 days (Ehmann and Ingamells, RIR-22-002-81, Acc. No. ?). The major degradates were SD 47117 and SD 44607; SD 10944, SD 58086, SD 993, and SD 54597 were minor degradates. [^{14}C]Fenvalerate (SS isomer only), at ~0.6 μg/cm^2, degraded with half-lives of 2, 6, and 18 days on clay, sandy clay, and sandy loam soil, respectively, irradiated with natural sunlight (Mikami et al., 1980, Acc. No. ?). $CONH_2$-Fenvalerate (SD 47114) was the major degradate.

Chlorophenyl- and phenoxyphenyl-labeled [^{14}C]fenvalerate (both racemic mixtures and pure SS isomers) degraded with a half-life of 65 to >365 days in a variety of soils incubated in the dark at 23-25°C and 70-81% of moisture holding capacity. Chlorophenyl-labeled [^{14}C]fenvalerate degraded with a half-life of 65 days in sandy loam soil, 96 days in silt loam soil, and 8

months in a second silt loam soil (Lee, 1979b, Acc. No. 245470). In the same soils, 23, 28, and 59% of the applied phenoxyphenyl-labeled [^{14}C]fenvalerate was undegraded after 12 months of incubation (?, 1979b, Acc. No. 245470). [^{14}C]SD 47443 (radiopurity >99%), a compound containing only the SS isomer of 4"-choloro-(2'''-isopropyl)phenylaceto-2-(3'-phenoxy)-phenylacetonitrile (fenvalerate), degraded with a half-life of 75 days in silt loam soil moistened to ~81% of field capacity and incubated in the dark at 25 C (Lee et al., 1985, Acc. No. 258842). In all studies, $^{14}CO_2$ was the major degradation product; SD 48838, SD 47117, SD 46116, SD 44607, SD 53065, and SD 44064 were detected at generally <5% of the applied (?, 1979a and b, Acc. No. 245470; Lee 1979a and b, Acc. No. 245470; Lee and Stackpole, 1979, Acc. No. 245470; Lee et al., 1985, Acc. No. 258842). Anaerobic (flooded soil plus a nitrogen atmosphere) degradation proceeded at a rate similar to aerobic degradation in sandy loam and two silt loam soils treated with either chlorophenyl- or phenoxyphenyl-labeled [^{14}C]-fenvalerate (?, 1979a, Acc. No. 245470; Lee, 1979a, Acc. No. 245470.

Chlorophenyl ring-labeled [^{14}C]fenvalerate was immobile in columns of sand, sandy loam, loam, and silt loam soils leached with ~20 inches of water; >88% of the applied fenvalerate remained in the upper 3 cm of the columns (Lee, TIR-22-103-79, Acc. No. 243109). Using soil TLC, the R_f of fenvalerate was 0.00 in sandy loam, silty clay loam, sand, and silt loam soil (Merritt, TIR-22-102-77, Acc. No. 096386). In a sandy loam soil:solution slurry (5 g: 3500 ml), the K_{ads} was >15,000 and adsorption was only slowly reversible (Porter, TIR-14-100-77, Acc. No. 096385). Aged [^{14}C]fenvalerate residues (uncharacterized) were immobile in a column of sandy loam soil; aged (30 day) chlorophenyl ring-labeled [^{14}C]fenvalerate residues, which consisted of fenvalerate, SD 44064, and SD 48838, were immobile in a column of sandy loam soil leached with ~20 inches of water (Jackson and Roberts, 1976, Acc. No. 096386; Lee, TIR-22-103-79, Acc. No. 243109).

Chlorophenyl-labeled [^{14}C]fenvalerate, at 0.35 ppm, did not volatilize from water during a 5-hour study; fenvalerate adsorbed strongly to glass, teflon, and polypropylene surfaces (Potter, TIR-22-103-75, Acc. No. 096386).

Fenvalerate (2.4 lb/gal EC) degraded with a half-life of 25 days in a sandy loam soil in Arizona, 34 days in a clay loam soil in Oklahoma, 54 days in a silt loam soil in Louisiana, and 54 days in a sandy loam soil in Alabama following 10-15 applications at 0.2 lb ai/A (Barber, TIR-24-140-79-D, Acc. No. 243109; Gilliland, 1979, Acc. No. 243109; Huston, TIR-24-381-78-B, and TIR-24-391-78, Acc. No. 243109). SD 47117, SD 48838, and SD 44064 were not detected in samples taken 45 and 180 days after the final treatment in Alabama, Arizona, and Louisiana; SD 47117 and SD 44064 were not detected in samples from Oklahoma but SD 44064 measured 0.02 ppm in one sample (RIR-24-135-79-D, RIR-24-140-79-C, RIR-24-391-78-C, RIR-24-381-78-D, Acc. No. ?).

Chlorophenyl- and phenoxyphenyl-labeled [^{14}C]fenvalerate residues ranged from <0.01 to 0.061 ppm in mature rotational crops planted 30-120 days after soil was treated with [^{14}C]fenvalerate at 0.25 lb ai/A; residues in lettuce were <0.01 ppm, in beets were 0.015-0.08 ppm (tops) and <0.01-0.25 ppm (roots), and in wheat was 0.013-0.061 ppm (straw), <0.01-0.022 ppm (bran), and <0.01-0.021 ppm (grain) (Fan and Lee, TIR-22-004-80, Acc. No. 242588). Extractable chlorophenyl- and phenoxyphenyl-labeled [^{14}C]fenvalerate residues ranged from 0.02 to 0.33 ppm in mature rotational crops planted 30 days after the soil was treated with [^{14}C]fenvalerate at 2.0 lb ai/A; extractable residues in lettuce were 0.02-0.03 ppm, in beets were 0.10-0.18 ppm (tops) and 0.27-0.31 ppm (roots), and in wheat were 0.29-0.33 ppm (straw), 0.07-0.08 ppm (bran), and 0.04 ppm (grain) (Lee et al., 19??, Acc. No. ?). In crops planted 120 days posttreatment, [^{14}C]residues were ≤0.05 ppm.

Fenvalerate and SD 47117 were not detected (<0.01 ppm) in beet root and top samples planted in sandy loam soil in New Jersey immediately after the last of ten applications of fenvalerate (2.4 lb/gal EC) at 0.2 lb ai/A (Crop Testing Services of NJ, Inc., RIR-24-220-85, Acc. No. 261050). A total of 2.0 lb ai/A were applied to the soil; the soil contained 1.2 ppm of fenvalerate at the time of planting. Fenvalerate was not detected (<0.01 ppm) in immature wheat and onions and mature table beets, sugar beets, carrots, and lettuce planted in sandy loam soil in Brawley, California, 30 and 60 days after the last of ten applications of fenvalerate

at 0.2 lb ai/A (Barber, TIR-24-149-79, Acc. No. 242588). Fenvalerate and SD 47117 were not detected (<0.01 ppm) in collards or wheat (grain and straw) planted in California 30, 120, and 400 days after the last of ten applications of fenvalerate at 0.2 lb ai/A; fenvalerate and SD 47117 were not detected in radishes planted 30 and 400 days after the final application, but fenvalerate was 0.01-0.02 ppm in radishes planted 120 days after the final application (?, 19??, Acc. No. 248812). Fenvalerate was not detected (<0.01 ppm) in soybeans, sorghum, and sugar beets planted in sandy loam soil in California ~250 days after the last of eight applications of fenvalerae at either 0.2 or 0.4 lb ai/A (Huston, TIR-24-266-78-B, Acc. No. 242588). Fenvalerate was not detected (<0.01 ppm) in table beets planted in sandy loam soil in California ~287 days after the last of ten applications of fenvalerate at 0.2 lb ai/A (?, 19??, Acc. No. 248812).

Chlorophenyl ring-labeled [^{14}C]fenvalerate residues accumulated with a maximum bioconcentration factor of 407x in the edible tissue of rainbow trout exposed to fenvalerate at 0.09-0.32 ppb for 35 days (Potter, TIR-22-105-76, Acc. No. 096386). A static exposure system was used; fish were moved to new aquaria every 3-4 days. The maximum concentration of [^{14}C]-residues in the edible tissue was 55 ppb; ~90% of the residues were fenvalerate.

Recommendations

The following data are required to fully assess the environmental fate and transport of, and the potential exposure to fenvalerate based on the data previously reviewed by Dynamac and EPA: hydrolysis studies; photodegradation studies in water; and laboratory accumulation in fish studies.

Hydrolysis studies: Two studies have been submitted to date. One study (Williams, Acc. No. 243109) does not fulfill data requirements because the test substance was not technical grade or purer, the incubation temperature was >25°C, and the study was not conducted for a sufficient length of time. The second study (?, Acc. No. 096386) does not fulfill data requirements because it was not specified that the study was conducted in the dark, the test substance was uncharacterized, the concentration of cosolvent exceeded

1% by volume, the incubation temperature was >25°C, the test solutions were not buffered, degradates >10% of the applied were not characterized, a material balance was not provided, and a portion of the applied fenvalerate adhered to the glass sample flask rather than being dissolved in the solution.

Photodegradation in water studies: Two studies have been submitted to date. One study (Fan, TIR-22-101-76, Acc. No. 096386) does not fulfill data requirements because degradates >10% of the applied were not characterized. The second study (Mikami et al., 1980, Acc. No. ?) does not fulfill data requirements because insufficient data were provided to determine the photodegradation rate of fenvalerate in water.

Photodegradation on soil studies: Based on the data submitted to date, no additional data are required.

Photodegradation in air studies: No data have been submitted to date. However, because of the low vapor pressure (1.1×10^{-8} mm Hg at 25°C) and high adsorptive behavior of fenvalerate, no data are required.

Aerobic soil metabolism studies: Based on the data submitted to date, no additional data are required.

Anaerobic soil metabolism studies: No data were submitted; however, no data are required because adequate anaerobic aquatic metabolism studies have been submitted.

Anaerobic aquatic metabolism studies: Based on the data submitted to date, no additional data are required.

Aerobic aquatic metabolism studies: No data were submitted; however, no data are required because fenvalerate has no aquatic or aquatic impact use.

Leaching and adsorption/desorption studies: Based on the data submittd to date, no additional data are required.

Laboratory volatility studies: Although the data submitted (Potter, TIR-22-103-75, Acc. No. 096386) do not fulfill data requirements, no data are required because of the low vapor pressure and high adsorptive properties of fenvalerate.

Field volatility studies: No data were submitted; however, no data are required because of the low vapor pressure and high adsorptive properties of fenvalerate.

Terrestrial field dissipation studies: Based on data submitted to date, no additional data are required.

Aquatic field dissipation studies: No data were submitted; however, no data are required because fenvalerate has no aquatic food crop, aquatic noncrop, or aquatic impact use.

Forestry dissipation studies: No data were submitted; however, no data are required because fenvalerate has no forestry use.

Dissipation studies for combination products and tank mix uses: No data were submitted; however, no data are required because data requirements for combination products and tank mix uses are currently not being imposed.

Long term field dissipation studies: No data have been submitted; however, no data are required because >50% of the applied fenvalerate dissipates during a growing season.

Confined accumulation studies on rotational crops: Based on the data submitted to date, no additional data are required.

Field accumulation studies on rotational crops: Based on the data submitted to date, no additional data are required.

Accumulation studies on irrigated crops: No data were submitted; however, no data are required because fenvalerate has no aquatic food crop or aquatic noncrop use.

Laboratory studies of pesticide accumulation in fish: Based on the one study submitted that most closely satisfies current data requirements (Potter, TIR-22-105-76, Acc. No. 096386), this study does not fulfill data requirements because a static exposure system was used, [^{14}C]residues in the water were not characterized, and residues in the viscera and whole fish were not quantified or characterized.

Field accumulation studies on aquatic nontarget organisms: No data have been submitted to date; however, no data are required because fenvalerate has no forestry, aquatic noncrop, or aquatic impact uses.

Reentry studies: No data have been submitted to date.

The following studies were previously reviewed by EPA and contribute to the partial fulfillment of environmental fata data requirements.

REFERENCES

? 1979--Residue data for some possible degradation products of SD 43775 in soil receiving 10 and 15 applications of SD 43775, a Louisiana study. RIR-24-391-78-C. Acc. No. ?

? 1978--Residue data for some possible degradation products of SD 43775 in undisturbed soil receiving 15 applications of SD 43775, an Oklahoma study. RIR-24-381-78-D. Acc. No. ?

? 1979--Residue data for some possible degradation products of SD 43775 in soil receiving 10 and 15 applications of SD 43775, an Alabama study. RIR-24-135-79-D. Acc. No. ?

? 1979--Residue data for some possible degradation products of SD 43775 in soil receiving 10 and 15 applications of SD 43775, an Arizona study. RIR-24-140-79-C. Acc. No. ?

? 1982--Residue data for SD 43775 in radishes following 38 or 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1982--Residue data for SD 47117. A possible soil metabolite of SD 43775 in radishes following 38 ro 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1982--Residue data for SD 43775 in soil from radishes following 38 or 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1982--Residue data for SD 47117, a possible soil metabolite of SD 43775 in soil from radishes following 38 or 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1982--Residue data for SD 43775 in collards following 38 or 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1982--Residue data for SD 47117, a possible soil metabolite of SD 43775, in collards following 38 or 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1982--Residue data for SD 43775 in soil from collards following 38 or 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1982--Residue data for SD 47117, a possible soil metabolite in soil, from collards following 38 or 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1982--Residue data for SD 43775 in wheat following 38 or 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1982--Residue data for SD 47117, a possible soil metabolite of SD 43775, in wheat following 38 or 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1982--Residue data for SD 43775 in soil from wheat following 38 or 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1982--Residue data for SD 47117, a possible soil metabolite of SD 43775 in soil, from wheat following 38 or 48 applications of SD 43775 to cotton, a California study. Acc. No. 248812.

? 1977. Hydrolytic stability of WL 43775. Acc. No. 096386.

? 1979a. Aerobic and anaerobic soil metabolism of ^{14}C-phenoxyphenyl SD 43775. Acc. No. 245470.

? 1979b. Twelve month aerobic soil metabolism study of ^{14}C-phenoxyphenyl SD 43775. Acc. No. 245470.

Barber, G.F. 1979. 1979--Dissipation of SD 43775 in undisturbed soil following fifteen applications of SD 43775 to cotton, an Arizona study. TIR-24-140-79-D. Acc. No. 243109.

Barber, G.F. 1980. 1979--Residue data for SD 43775 in rotation crops (wheat, table beets, sugar beets, onions, carrots, and lettuce) following ten applications of SD 43775 to cotton the previous year, a California study. Shell Chemical Company. TIR-24-149-79. Acc. No. 242588.

Barber, G.F. 1980. 1978--Residue data for SD 43775 in rotation crops (carrots, onions, beets, and lettuce) following ten applications of Sd 43775 to cotton, a Texas study. Shell Chemical Company. TIR-24-401-78. Acc. No. 242588.

Crop Testing Services of NJ, Inc. 1985. 1985--Residue data for SD 43775 and SD 47117 in table beets following ten applications of SD 43775 to spinach, a New Jersey study. RIR-24-220-85. Shell Oil Company, Washington, D.C. Acc. No. 261050.

Ehmann, A. and J.M. Ingamells. 1981. Photodegradation of SD 43775 on soil thin layers. RIR-22-002-81. Acc. No. ?

Fan, H.Y. 19?? Photochemical degradation of chlorophenyl-labeled 14-C SD 43775 on soil. TIR-22-101-76. Acc. No. 097296.

Fan, H.Y. 19?? Photochemical degradation of SD 43775 on glass and soil. TIR-22-109-78. Acc. No. 097296.

Fan, H.Y. 19?? Photochemical degradation of SD 43775 on silica gel, glass, soil, and in water. TIR-22-101-76. Acc. No. 096386.

Fan, H.Y. and P.W. Lee. 1980. A 30, 60, and 120-day rotation crop study using carbon-14 labeled chlorophenyl- and phenoxyphenyl-SD 43775. Shell Chemical Company. TIR-22-004-80. Acc. No. 242588.

Gilliland, F.R. 1979. 1979--Dissipation of SD 43775 in undisturbed soil following 15 ground spray applications of SD 43775 to cotton; an Alabama study. Agricon, Inc. Acc. No. 243109.

Houston, C.K. 1978. Dissipation of SD 43775 in undisturbed soil receiving fifteen ground spray applications of SD 43775 to cotton, a Louisiana study. TIR-24-391-78. Acc. No. 243109.

Houston, C.K. 1978. 1979--Residue data for SD 43775 in undisturbed soil receiving 5, 10, or 15 ground spray applications of SD 43775 to cotton, an Oklahoma study. TIR-24-381-78-B. Acc. No. 243109.

Houston, C.K. 1980. 1978--Residue data for SD 43775 in rotation crops (soybeans, sorghum, and sugar beets) following eight applications of SD 43775 the previous year to cotton, a California study. Shell Chemical Company. TIR-24-266-78-B. Acc. No. 242588.

Jackson, C. and T.R. Roberts. 1976. The leaching behavior WL 43775 in laboratory soil columns. Acc. No. 096386.

Lee, P.W. 19?? Leaching study of SD 43775 by soil column chromatography. TIR-22-103-79. Acc. No. 243109.

Lee, P.W., S.M. Sterns and W.R. Powell. 19?? A 30- and 120-day rotation crop study using ^{14}C-SD 43775 following a single soil treatment at a dosage rate of 2 lb ai/A. Acc. No. ?

Lee, P.W. 1979a. Aerobic and anaerobic soil metabolism of ^{14}C-chlorophenyl SD 43775. Acc. No. 245470.

Lee, P.W. 1979b. Twelve months aerobic soil metabolism of ^{14}C-chlorophenyl SD 43775. Acc. No. 245470.

Lee, P.W. and S.C. Stackhouse. 1979. Comparative anaerobic metabolism of ^{14}C-chlorophenyl SD - 43775 in sterilized and nonsterilized Hanford sandy loam soils. Acc. No. 245470.

Lee, P.W., S.M. Sterns, and W.R. Powell. 1985. Comparative aerobic soil metabolism of SD 43775 (racemic) and SD 47443 (A-Alpha). Report MO-RIR-22-011-85. Shell Development Company, Modesto, California. Acc. No. 258842.

Merritt, R.L. 19?? Leaching studies of SD 43775 and selected reference pesticides by soil thin-layer chromatography. TIR-22-102-77. Acc. No. 096386.

Mikami, N., N. Takahashi, K. Hayashi, and J. Miyamoto. 1980. Photodegradation of fenvalerate (Sumicidin) in water and on soil surface. J. Pest. Sci. 5:225-236. Acc. No. ?

Porter, P.E. 19?? Sorption of SD 43775 on soils. TIR-14-101-77. Acc. No. 096385.

Potter, J.C. 19?? Residues of ^{14}C and SD 43775-^{14}C in fish exposed to SD 43775-^{14}C. TIR-22-105-76. Acc. No. 096386.

Potter, J.C. 19?? Vaporization and sorption of SD 43775 from water solutions. TIR-22-103-75. Acc. No. 096386.

Williams, K.S. 19?? Hydrolytic stability of Pydrin 2.4 EC insecticide. Acc. No. 243109.

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APPENDIX I

STUDIES WHICH WERE PREVIOUSLY REVIEWED BUT DO NOT CONTRIBUTE TO THE FULFILLMENT OF ENVIRONMENTAL FATE DATA REQUIREMENTS.

The following studies were previously reviewed by EPA but do not contribute to the fulfillment of data requirements, either because the studies are deficient or are not pertinent to current environmental fate data requirements.

Studies with a registrant-assigned identification code

AM-70-0036. Degradation of fenvalerate (sumicidin) in soil. (Ohkawa, H. and K. Nambu.) Acc. No. 096386.

BW-78-1-018. Chronic toxicity of SD 43775 to the fathead minnow (Pimephales promelae). Acc. No. 097000.

MMS-R-423-1. Residue determination of SD 43775 in cottonseed and leaves of cotton plants. Acc. No. 096390.

MMS-R-439-1. Determination of SD 43775 residues in cottonseed. Electron-capture gas chromatographic method. Acc. No. 096390.

MMS-R-456-1. Determination of SD 43775 residues in crops. Electron-capture gas chromatographic method. Acc. No. 096390 and 096648.

MMS-R-447-2. Determination of SD 43775 residues in animal tissues, milk fat, cream, hair, eggs, and gauze patches. Electron-capture gas chromatographic method. Acc. No. 096390.

SBL 12/77/I/AC 407. The metabolism of the pyrethroid insecticide WL 43775 in apple fruit and foliage under outdoor conditions. (M.E. Tander). Acc. No. 096648.

RIR-24-142-83. 1983--Residue data for SD 43775 in table beets grown in soil which had previously received ten applications of SD 43775, a California study. (Skelsey, J.J.) Acc. No. 261050.

TIR-22-100-79. Determination of the antimicrobial activities of SD 43775 and SD 42049. (Stackhouse, S.C.) Acc. No. 243109.

TIR-22-102-76. Residues of ^{14}C in milk and tissue from cows fed SD 43775-^{14}C. Acc. No. 093690.

TIR-22-102-78. ^{14}C and SD 43775 residues in catfish exposed to a water/soil suspension treated with SD 43775-^{14}C. (Potter, J.C., G.F. Barber, and C.R. Sauls). Acc. No. 097000.

TIR-22-103-75. Sorption of SD 43775 by glass and teflon surfaces from aqueous solutions. (J.C. Potter). Acc. No. 096386.

TIR-22-103-76. Residue of ^{14}C in eggs and tissues from laying hens fed SD 43775-^{14}C. Acc. No. 093690

TIR-22-103-77. Residues in fat tissues from rats fed ^{14}C-SD 43775.

TIR-22-105-77. Metabolism in the livers of rats fed ^{14}C-SD 43775. (Boyer, A.C.). Acc. No. 096385.

TIR-22-106-76. Residues of ^{14}C in tissues of rats fed SD 43775-^{14}C for 28 days. (Potter, J.C. and D.L. Arnold.) Acc. No. 096385.

TIR-22-107-76. Carbon-14 content of cottonseed after single and multiple treatment of squares with ^{14}C-(chlorophenyl)-SD 43775. (J.E. Loeffler). Acc. No. 096390.

TIR-22-107-77. One-year study of the fate of ^{14}C-SD 43775 in soil. (Fan, H.Y.) Acc. No. 096386.

TIR-22-108-76. Degradation of ^{14}C (chlorophenyl) SD 43775 during exposure to soil under aerobic, anaerobic, and sterile conditions. (Loeffler, J.E.) Acc. No. 096386.

TIR-22-108-77. Impact of Pydrin insecticide on microorganisms in the soil environment. (Rader, W.E. and W. Love.) Acc. No. 096386.

TIR-22-109-77. Identification of metabolites found in the urine of rats fed ^{14}C-SD 43775. (Boyer, A.C.) Acc. No. 096385.

TIR-22-110-76. Investigation of the transport of ^{14}C-(chlorophenyl)-SD 43775 from treated to untreated leaves. Acc. No. 096390.

TIR-22-110-77. Identification of metabolites found in the feces of rats fed ^{14}C-SD 43775. Acc. No. 096385.

TIR-22-111-77. Residues of ^{14}C in milk and tissue from cows fed SD 43775-^{14}C. Acc. No. 093690

TIR-22-112-76. Residues of Carbon-14 in milk and tissue from cows fed SD 43775-^{14}C. Acc. No. 093690.

TIR-22-112-77. Impact of commercial Shell pesticides on microorganisms in the soil. Part III. Effect of compounds on the population of microorganisms and the O_2/CO_2 exchange in treated soil. (Rader, W.E., Love, and Chai) Acc. No. 243109.

TIR-22-112-77. Impact of commercial Shell pesticides on microorganisms in the soil. Part IV. The effect of the compounds on soil nitrification. (Rader, W.E.) Acc. No. 243109.

TIR-22-112-77. Impact of commercial Shell products on microorganisms in the soil--effect on nodulation on pinto beans and on the nitrogen fixation bacteria. (Rader, W.E. and J.W. Love.) Acc. No. 096386.

TIR-22-113-76. Thin-layer chromatography of SD 43775-treated cotton leaves. Acc. No. 096648.

TIR-22-113-77. Residue studies in rotation crops in ^{14}C-SD 43775-treated soils. (Fan, H.Y.) Acc. No. 096386.

TIR-22-114-77. Identification of non-polar metabolites from ^{14}C-SD 43775 - treated cotton fibers. Acc. No. 096390.

TIR-22-115-76 and TIR-22-117-76. Metabolism of WL 43775 by rat liver enzymes: Parts I and II. (Boyer, A.C.) Acc. No. 096385, 01211, and 01218.

TIR-22-116-77. Solution photochemistry of SD 43775. (Ehmann, A.) Acc. No. 096386.

TIR-22-117-77. Fate of SD 43775 applied to open cotton balls. Acc. No. 096390.

TIR-22-118-76. Carbon-14-bound residues from livers of rats fed ^{14}C-SD 43775. Acc. No. 096383.

TIR-22-118-77. Residues of ^{14}C in tissues of rat fed SD 43775- ^{14}C. (Potter, J.C.) Acc. No. 096385.

TIR-22-120-79. Metabolism of SD 43775 by enrichment cultures initiated from freshly collected and pretreated sandy loam soil. (Stackhouse, S.C.) Acc. No. 243109.

TIR-22-167-79. 1979--Residue data for SD 43775 in rotational crops (wheat, radishes, and potato foliage) following various applications of SD 43775 to cotton and potatoes, an Arizona study. (Barber, G.F.) Acc. No. 242588.

TIR-23-127-75. Dissipation of SD 43775 in soil at Monroe, LA. Acc. No. 096386.

TIR-24-125-76. 1976--Residue data for SD 43775 in rotation crops (onions and sorghum) following eight applications of SD 43775 the previous year to cotton, a Texas study. Acc. No. 096386.

TIR-24-140-79-B. 1979--Residue data for SD 43775 in soil following various applications to cotton and potatoes, an Arizona study. (Barber, G.F.) Acc. No. ?

TIR-24-145-77. 1977--Residue data for SD 43775 in a rotation crop (wheat and vetch) following nine applications of SD 43775 the previous year to cotton, a California study. Acc. No. 096386.

TIR-24-145-77-B. 1977--Residue data for SD 43775 in rotation crops (sugar beets, soybeans, and sorghum) following nine applications of SD 43775 the pervious year to cotton, a California study. Acc. No. ?

TIR-24-149-79. 1979--Residue data for SD 43775 in rotation crops (wheat, table beets, sugar beets, onions, carrots, and lettuce) following ten applications of SD 43775 to cotton the previous year, a California study. (Barber, G.F.) Acc. No. 242588.

TIR-24-196-77. 1977--Residue data for SD 43775 in soil resulting from eight applications of SD 43775 to cotton, a California study. (Huston, C.K.) Acc. No. 242588.

TIR-24-201-75. 1975--Residue data for SD 43775 in rotation crops (alfalfa, potatoes, wheat, and soybeans) from a simulated rotation study, a California study. Acc. No. 096386.

TIR-24-209-79. 1979--Residue data for SD 43775 in rotational crops (green wheat) following 10 or 15 applications of SD 43775 to cotton the previous year, an Oklahoma study. (Barber, G.F.) Acc. No. 242588.

TIR-24-209-79-B. 1979--Residue data for SD 43775 in rotational crops (potatoes) following various applications for SD 43775 to cotton and

potatoes, an Oklahoma study. (Barber, G.F.) Acc. No. 242588.

TIR-24-232-77. 1977--Residue data for SD 43775 in soil resulting from ten applications of SD 43775 to cotton plants, a Texas study. Acc. No. 096386.

TIR-24-256-77. 1977--Residue data for SD 43775 in soil of a cotton field resulting from one foliar application to the cotton, a California study. Acc. No. 096386.

TIR-24-266-78. 1978--Residue data for SD 43775 in a rotation crop (wheat) following eight applications of SD 43775 the previous year to cotton, a California study. (Barber, G.F.) Acc. No. 242588.

TIR-24-266-78-B. 1978--Residue data for SD 43775 in rotation crops (soybeans, sorghum, and sugar beets) following eight applications of SD 43775 the previous year to cotton, a California study. (Huston, C.K.) Acc. No. 242588.

Barber, G.F. 1980. 1979--Residue data for SD 43775 in rotation crops (soybeans and peanuts) following various applications of SD 43775 to cotton, soybeans, and peanuts, a Louisiana study. TIR-24-278-79. Acc. No. 242588.

TIR-24-312-75. Dissipation of SD 43775 in soil at Wenatchee, Washington. Acc. No. 096386.

TIR-24-381-78-C. 1979--Residue data for SD 43775 in soil receiving seven ground spray applications of SD 43775 to potatoes following 10 or 15 applications the previous year to cotton, an Oklahoma study. (Huston, C.K.) Acc. No. 242588.

TIR-24-391-78-B. 1979--Residue data for SD 43775 in soil receiving 10 or 15 applications of SD 43775 to cotton in 1978 followed by 3 or 4 applications to peanuts or soybeans in 1979, a Louisiana study. (Barber, G.F.) Acc. No. 242588.

TIR-24-400-78. 1978--Residue data for SD 43775 in soil resulting from ten applications of SD 43775 to cotton, a Texas study. (Nugent, K.D.) Acc. No. 242588.

TIR-24-401-78. 1980--Residue data for SD 43775 in rotation crops (carrots, onions, beets, and lettuce) following ten applications of SD 43775 to cotton, a Texas study. (Barber, G.F.) Acc. No. 242588.

TIR-24-603-76. SD 43775--Gas liquid chromatographic interference study. Acc. No. 096390.

TIR-24-635-77. Intensive study of the environmental effects and residues resulting from practical application of Pydrin insecticide. Acc. No. 097000.

TIR-51-108-79. The effects of shell pesticides on protein decomposition. (Rader, W.E.) Acc. No. 243109.

TIR-51-110-79. The effect of Shell pesticides on soil phosphatase activity. (Rader, W.E.) Acc. No. 243109.

TIR-51-111-79. The effects of Shell pesticides on cellulose decomposition. (Rader, W.E. and I.G. Blake.) Acc. No. 243109.

TIR-51-112-79. The effects of SD 43775 on activated sludge metabolism. (Rader, W.E. and I.G. Blake) Acc. No. 243109.

TIR-76-003-76. Determination of antimicrobial activity of selected pyrethroid compounds. (Salani, J.P.) Acc. No. 096386.

WK 3/I/AC 304. The metabolism of the pyrethroid insecticide WL 43775 (Belmark) in lettuce and soil under outdoor conditions. (E.J. Hitchings) Acc. No. 096648.

Studies for which no identifying code was provided:

? 19?? Fish toxicity studies with SD 43775. Acc. No. 096386.

? 1983--Residue data for SD 43775 in table beets grown in soil which had previously received ten applications of SD 43775, a California study. Acc. No. ?

? Runoff study--field trial at BSRC. Test SD 43775. 76-1. Acc. No. 096386.

Majure, T.C. 19?? An investigation of the short-term effects on and residues in the aquatic environment resulting from pesticidal applications of Pydrin insecticide to cotton in Mississippi. Acc. No. 09700.

Mima, T. and R. Tolshaski. 19?? Effects of a synthetic pyrethroid, SD 43775 on nontarget organisms when utilized as a mosquito larvicide. Acc. No. 096386.

Ohkawa, H., K. Nambu, H. Kaneks, and R. Kikuch. 19?? Metabolic fate of fenvalerate in rats, soil, soil microorganisms, and an aquatic ecosystem. Acc. No. 096386.

Ohkawa, H. and R. Kikuchi. 19?? Toxicity of fenvalerate to killifish (Oryzios latipes) in an aquarium containing soil. Acc. No. 096386.

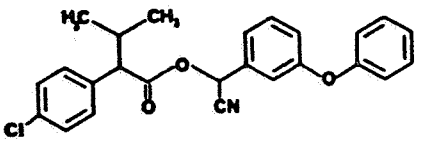
Ohkawa, H., R., Kikuchi, and J. Miyamoto. 1980. Bioaccumulation and biodegradation of the (S)-acid isomer of fenvalerate (Sumicidin) in an aquatic model ecosystem. J. Pest. Sci. 5:11-22. Acc. No. ?

Ohkawa, H., K. Nambu, and J. Miyamoto. 1980. Metabolic fate of fenvalerate (Sumicidin) in bean plants. J. Pest. Sci. 5:215-223. Acc. No. ?

Ohkawa, H., K. Nambu, H. Inui, and J. Miyamoto. 1978. Metabolic fate of fenvalerate (Sumicidin) in soil and by soil microorganisms. J. Pest. Sci. 3:129-141. Acc. No. ?

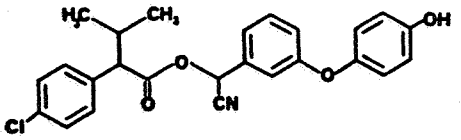
APPENDIX II

STRUCTURES OF FENVALERATE AND ITS DEGRADATES



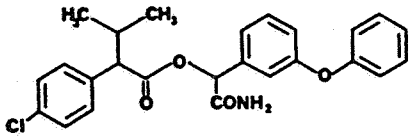
4''-Chloro-(2'''-isopropyl)phenylaceto-2-(3'-phenoxy)phenylacetonitrile

(All isomers; SD 43775, SD 47443)



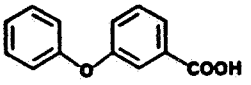
4''-Chloro-(2'''-isopropyl)phenylaceto-2-(3'-hydroxyphenoxy)phenylacetonitrile

(SD 48838)



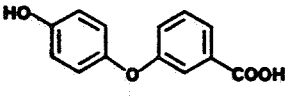
4''-Chloro-(2'''-isopropyl)phenylaceto-2-(3'-phenoxy)phenylacetamide

(SD 47117)



3-Phenoxybenzoic acid

(SD 44607)



4-(Hydroxyphenoxy)benzoic acid

(SD 46116)

Figure 1. 4''-Chloro-(2'''-isopropyl)phenylaceto-2-(3'-phenoxy)phenylacetonitrile and its degradates.