

Data Evaluation Report on the acute toxicity of Penoxsulam metabolite on the Algae, *Selenastrum capricornutum*


PMRA Submission #: {.....}

EPA MRID #: 45831112

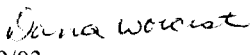
Data Requirement: PMRA DATA CODE {.....}
EPA DP Barcode D288160
OECD Data Point {.....}
EPA MRID 45831112
EPA Guideline 122-2

Test material: Penoxsulam Purity: 99%
Common name: XDE-638 metabolite BSA
Chemical name: IUPAC: triethylamine salt of 2-(2,2-difluoroethoxy)-6-trifluoromethylbenzene sulfonic acid
CAS name: Not reported
CAS No.: Not reported
Synonyms: XDE-638 sulfonic acid metabolite


Primary Reviewer: Rebecca Bryan
Staff Scientist, Dynamac Corporation

Signature: 
Date: 12/29/03

QC Reviewer: Dana Worcester
Staff Scientist, Dynamac Corporation

Signature: 
Date: 12/29/03

Primary Reviewer: ~~Bill Erickson~~ J. GOODYEAR
{EPA/OECD/PMRA}

Date: {.....} 

Secondary Reviewer(s): {.....}
{EPA/OECD/PMRA}

Date: {.....}

Company Code {.....} [For PMRA]
Active Code {.....} [For PMRA]
EPA PC Code 199031 119C31

Date Evaluation Completed: {dd-mmm-yyyy}

CITATION: Herrera, R. 2002. XDE-638 Metabolite BSA (TSN 101980): Growth Inhibition Test with the Freshwater Green Alga, *Selenastrum capricornutum* PRINTZ. Unpublished study performed by ESG International Inc., Guelph, Ontario, Canada. Laboratory Study No. S2288-02. Study submitted by The Dow Chemical Company, Midland, Michigan, U.S.A. for Dow AgroSciences, LLC, Indianapolis, Indiana, U.S.A. Dow Study No. 021092. Experimental start date was April 15, 2002 and the experimental termination date was April 19, 2002. The final report issued August 2002.



EXECUTIVE SUMMARY:

In a 96-hour acute toxicity study, cultures of *Selenastrum capricornutum* were exposed to Penoxsulam metabolite, BSA, under static conditions. A single nominal concentration was tested (1.6 mg/L), which was compared to a dilution water control; analytical verification of the nominal test concentration was not conducted. The 96-hour cell density, growth rates, and biomass percent inhibitions were -9.7, -1.6, and -9.5%, respectively, in the 1.6 mg/L treatment group (negative values indicate stimulations, no inhibitory effect). **The EC₅₀ was >1.6 mg/L and the NOAEC of Penoxsulam metabolite (BSA) was 1.6 mg a.i./L for all endpoints.**

This toxicity study is scientifically sound, however, it does not satisfy the U.S. EPA Guideline Subdivision J, §122-2 **because the nominal test concentration was not analytically verified.** As a result, this study is classified as Supplemental, but it need not be repeated.

Results Synopsis

Test Organism: *Selenastrum capricornutum*

Test Type: Static

Cell density:

NOAEC: 1.6 mg/L

EC₀₅: ND

EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Growth rates:

NOAEC: 1.6 mg/L

EC₀₅: ND

EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Plant biomass (area under the growth curve):

NOAEC: 1.6 mg/L

EC₀₅: ND

EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Endpoint(s) Affected: **None**

I. MATERIALS AND METHODS

GUIDELINE FOLLOWED: The test was based on the following guidelines: Organization for Economic Cooperation and Development (OECD), Method #201, "Alga, Growth Inhibition Test" (1984); U.S. Environmental Protection Agency, OPPTS Method 850.5400, "Algal Toxicity Tier I and II" (1996); and FIFRA Subdivision J Pesticide Assessment Guidelines (1982). The following deviations from U.S. EPA Guideline, §122-2 were noted:

1. The single test concentration was not analytically verified. This deviation affected the acceptability of the study.
2. The pretest health of the test organism was not reported.
3. The algal growth medium and dilution water characteristics were not reported.
4. The stability of the test substance was not determined.
5. The light intensity (8000 ± 1600 lux) was greater than recommended by EPA ($4 - 5 \pm 15\%$ Klux).

COMPLIANCE: Signed and dated GLP, Quality Assurance and No Data Confidentiality statements were provided. The test was conducted according to the OECD Principles of Good Laboratory Practice (GLP, 1998).

A. MATERIALS:

1. Test Material Penoxsulam metabolite (BSA)

Description: White powder

Lot No./Batch No. : F0500-84A

Purity: 99%

Stability of Compound

Under Test Conditions: The test concentration was not measured during the study, therefore, stability was not determined. OECD requirements were not reported.

(OECD requires water solubility, stability in water and light, pKa, Pow, vapor pressure of test compound)

Storage conditions of test chemicals: Stored at room temperature.

2. Test organism:

Name: *Selenastrum capricornutum*

EPA requires a nonvascular species: For tier I testing, only one species, S. capricornutum, to be tested; for tier II testing, S. costatum, A. flos-aquae, S. capricornutum, and a freshwater diatom is tested

OECD suggests the following species are considered suitable: S. capricornutum, S. subspicatus, and C. vulgaris. If other species are used, the strain should be reported

Strain: 1913

Source: Originally from UTCC #37. Current in-house laboratory cultures.

Age of inoculum: 3-7 days old

Method of cultivation: Algal growth medium (not described).

B. STUDY DESIGN:

a) Range-finding Study: No range-finding test was conducted.

b) Definitive Study

Table 1 . Experimental Parameters

| Parameter | Details | Remarks |
|---|--|--|
| | | Criteria |
| Acclimation period: | Continuous | |
| culturing media and conditions: (same as test or not) | Algal growth medium (not described); same as test. | <i>EPA recommends two week acclimation period.</i> |
| health: (any toxicity observed) | Not reported | <i>OECD recommends an amount of algae suitable for the inoculation of test cultures and incubated under the conditions of the test and used when still exponentially growing, normally after an incubation period of about 3 days. When the algal cultures contain deformed or abnormal cells, they must be discarded.</i> |
| Test system static/static renewal: | Static | |
| renewal rate for static renewal: | | |
| Incubation facility | Incubator-growth chamber | |
| Duration of the test | 96 hours | <i>EPA requires: 96 - 120 hours</i> <i>OECD: 72 hours</i> |
| Test vessel material: (glass/polystyrene) | Glass Erlenmeyer flasks | Test vessels covered with Jaece® nontoxic foam plugs. |

| Parameter | Details | Remarks |
|---|--|---|
| | | Criteria |
| size: fill volume: | 250 mL 50 mL | The fill volume is less than recommended. <i>OECD recommends 250 ml conical flasks are suitable when the volume of the test solution is 100 ml or use a culturing apparatus.</i> |
| Details of growth medium name: pH at test initiation: pH at test termination: Chelator used: Carbon source: Salinity (for marine algae): | Algal growth medium 6.71-7.38 7.54-7.61 Not reported Not reported N/A | Similar to U.S. EPA (1996) and ASTM (1997) mediums. The types of nutrients are identical. The medium meets the nutrient requirements in OECD (1984). <i>OECD recommends the medium pH after equilibration with air is ~8 with less than .001 mmol/l of chelator if used.</i> <i>EPA recommends 20X-AAP medium.</i> |
| If non-standard nutrient medium was used, detailed composition provided (Yes/No) | N/A | |
| Dilution water source: type: pH: salinity (for marine algae): water pretreatment (if any): Total Organic Carbon: particulate matter: metals: pesticides: chlorine: | Not reported Not reported 7.5 ± 0.1 N/A None Not reported Not reported Not reported Not detected Not reported | <i>EPA pH: <u>Skeletonema costatum</u> = ~8.0 Others = ~7.5 from beginning to end of the test. EPA salinity: 30-35 ppt. EPA is against the use of dechlorinated water.</i> <i>OECD: pH is measured at beginning of the test and at 72 hours, it should not normally deviate by more than one unit during the test.</i> |
| Indicate how the test material is added to the medium (added directly or used stock solution) | Stock solutions | |
| Aeration or agitation | Not reported. | <i>EPA recommends agitation only for <u>Selenastrum</u> at 100 cycles per min and <u>Skeletonema</u> at ~60 cycles per min.</i> |

| Parameter | Details | Remarks |
|---|--|--|
| | | Criteria |
| | | <i>Aeration is not recommended.</i> |
| Initial cells density | Approximately 10,000 cells/mL | <p><i>EPA requires an initial number of 3,000 - 10,000 cells/mL. For <i>Selenastrum capricornutum</i>, cell counts on day 2 are not required.</i></p> <p><i>OECD recommends that the initial cell concentration be approximately 10,000 cells/ml for <i>S. capricornutum</i> and <i>S. subspicatus</i>. When other species are used the biomass should be comparable.</i></p> |
| Number of replicates control: solvent control: treated ones: | 6 N/A 6 | <p><i>EPA requires a negative and/or solvent control with 3 or more replicates per doses. <i>Navicula</i> sp. tests should be conducted with four replicates.</i></p> <p><i>OECD preferably three replicates at each test concentration and ideally twice that number of controls. When a vehicle is used to solubilize the test substance, additional controls containing the vehicle at the highest concentration used in the test cultures should be included in the test.</i></p> |
| Test concentrations nominal: measured: | 0 (negative control) and 1.6 mg/L Not determined. | <p>The test concentration was not measured.</p> <p><i>EPA requires at least 5 test concentrations, with each at least 60% of the next higher one.</i></p> <p><i>OECD recommends at least five concentrations arranged in a geometric series, with the lowest concentration tested should have no observed effect on the growth of the algae. The highest concentration tested should inhibit growth by at least 50% relatively to the control and, preferably, stop growth completely.</i></p> |

| Parameter | Details | Remarks |
|---|---|--|
| | | Criteria |
| Solvent (type, percentage, if used) | N/A | |
| Method and interval of analytical verification | N/A | |
| Test conditions temperature: photoperiod: light intensity and quality: | 24 ± 1°C Continuous 8000 ± 1600 lux, cool-white fluorescent light. | <i>EPA temperature: <u>Skeletonema</u>: 20 °C, Others: 24-25 °C; EPA photoperiod: S. costatum 14 hr light/ 10 hr dark, Others: Continuous; EPA light: Anabaena: 2.0 Klux (±15%), Others: 4 - 5 Klux (±15%)</i> <i>OECD recommended the temperature in the range of 21 to 25°C maintained at ± 2°C and continuous uniform illumination provided at approximately 8000 Lux measured with a spherical collector.</i> |
| Reference chemical (if used) name: concentrations: | Sodium Chloride (concentrations not reported) | The EC ₂₅ was 619.6 mg/L (95% confidence interval of 396.6-861.4 mg/L). |
| Other parameters, if any | None | |

2. Observations:

Table 2: Observation parameters

| Parameters | Details | Remarks/Criteria |
|---|--|--|
| Parameters measured including the growth inhibition/other toxicity symptoms | Cell count (area under the growth curve and growth rates were calculated). | <i>EPA recommends the growth of the algae expressed as the cell count per ml, biomass per volume, or degree of growth as determined by spectrophotometric means.</i> |
| Measurement technique for cell density and other end points | Cell counts using a haemocytometer. | <i>EPA recommends the measurement technique of cell counts or chlorophyll a</i> |

| Parameters | Details | Remarks/Criteria |
|--|--|---|
| | | <i>OECD recommends the electronic particle counter, microscope with counting chamber, fluorimeter, spectrophotometer, and colorimeter. (note: in order to provide useful measurements at low cell concentrations when using a spectrophotometer, it may be necessary to use cuvettes with a light path of at least 4 cm).</i> |
| Observation intervals | Every 24 hours | <i>EPA and OECD: every 24 hours.</i> |
| Other observations, if any | None | |
| Indicate whether there was exponential growth in the control | Yes, dilution water group cell densities at test termination was 406X greater than the dilution water control group cell densities at test initiation. | <i>EPA requires control cell count at termination to be $\geq 2X$ initial count or by a factor of at least 16 during the test.</i> <i>OECD: cell concentration in control cultures should have increased by a factor of at least 16 within three days.</i> |
| Were raw data included? | Yes | |

II. RESULTS and DISCUSSION:

A. INHIBITORY EFFECTS:

The 96-hour cell density, growth rates, and biomass percent inhibitions were -9.7, -1.6, and -9.5%, respectively, in the 1.6 mg/L treatment group (negative values indicate stimulations, no inhibitory effect).

Table 3: Effect of Penoxsulam metabolite, BSA, on Algae (*Selenastrum capricornutum*)

| Treatment mean measured and nominal concentrations ^a (mg/L) | Initial cell density (cells/mL) | Mean Cell density (cells/mL) at | | |
|--|---------------------------------|---------------------------------|------------|--------------|
| | | 24 hours | 96 hours | |
| | | | cell count | % inhibition |
| Dilution water control | 10,000 | 73,000 | 4,060,000 | -- |
| 1.6 | 10,000 | 82,000 | 4,454,000 | -9.7 |
| Reference chemical (if used) | N/A | N/A | N/A | N/A |

^a The test concentration was not measured.

Table 4: Effect of Penoxsulam metabolite, BSA, on Algae (*Selenastrum capricornutum*)

| Mean Nominal Treatment Concentrations ^a (mg/L) | Initial cell density (cells/ml) | Mean Growth Rate per day | % inhibition (Mean Growth Rate per day) | Mean Area Under Growth Curve | % inhibition (Mean Area Under Growth Curve) |
|---|---------------------------------|--------------------------|---|------------------------------|---|
| Dilution water control | 10,000 | 0.06208 | -- | 118,347,000 | -- |
| 1.6 | 10,000 | 0.06308 | -1.6 | 129,621,000 | -9.5 |
| Reference chemical (if used) | N/A | N/A | N/A | N/A | N/A |

^a The test concentration was not measured.

Table 5: Statistical endpoint values.

| Statistical Endpoint | Biomass | Growth rate | Cell density |
|--|---------|-------------|--------------|
| NOAEC | 1.6 | 1.6 | 1.6 |
| EC ₀₅ : | ND | ND | ND |
| EC ₅₀ (mg/L) | >1.6 | >1.6 | >1.6 |
| IC ₅₀ or EC ₅₀ (mg/L) (95% C.I.) | N/A | N/A | N/A |
| IC ₂₅ /EC ₂₅ (mg/L) (95% C.I.) | NR | NR | NR |
| Reference chemical, if used NOAEC IC ₅₀ /EC ₅₀ | N/A | N/A | N/A |

NR-Not Reported

N/A = Not applicable.

B. REPORTED STATISTICS:

Statistical Method: Percent inhibition was determined for all endpoints. The 96-hour NOAEC and EC₅₀ values were estimated using the significance data for all endpoints. All statistical calculations were performed using the nominal concentration.

Cell density:

NOAEC/EC₀₅: ≥1.6 mg/L

EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Growth rates:

NOAEC/EC₀₅: ≥1.6 mg/L

EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Plant biomass (area under the growth curve):

NOAEC/EC₀₅: ≥1.6 mg/L
EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Endpoint(s) Affected: **None**

C. VERIFICATION OF STATISTICAL RESULTS:

Statistical Method: Statistical analyses were not required, as there was no inhibition in this study.

Cell density:

NOAEC: 1.6 mg/L
EC₀₅: ND
EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Growth rates:

NOAEC: 1.6 mg/L
EC₀₅: ND
EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Plant biomass (area under the growth curve):

NOAEC: 1.6 mg/L
EC₀₅: ND
EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Endpoint(s) Affected: **None**

D. STUDY DEFICIENCIES:

The acceptability of the study was affected because the nominal test concentration was not analytically determined; as a result, the actual exposure of algae to XDE-638 metabolite BSA is unknown.

E. REVIEWER'S COMMENTS:

There was no inhibition in this study; however, because the single test concentration was not measured, actual exposure of the algae to the test material is unknown. As a result, this Tier I study is classified as Supplemental, but it need not be repeated.

The projected environmental concentration (PEC) for BSA is 16 µg/L.

F. CONCLUSIONS: This toxicity study is scientifically sound, however, it does not satisfy the U.S. EPA Guideline Subdivision J, §122-2 because the nominal test concentration was not analytically verified. As a result, this study is classified as Supplemental, but it need not be repeated. There was no inhibition of any algal endpoint, so the EC_x values exceed the single nominal test concentration, 1.6 mg/L.

Cell density:

NOAEC: 1.6 mg/L

EC₀₅: ND

EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Growth rates:

NOAEC: 1.6 mg/L

EC₀₅: ND

EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Plant biomass (area under the growth curve):

NOAEC: 1.6 mg/L

EC₀₅: ND

EC₅₀/IC₅₀: >1.6 mg/L 95% C.I.: N/A

Endpoint(s) Affected: **None**

III. REFERENCES:

- American Society for Testing and Materials (ASTM). 1997. Standard guide for conducting static 96-h toxicity tests with microalgae. Annual Book of ASTM Standards. American Society for Testing and Materials. West Conshohocken, PA. Vol. 11.05. E 1218-97a.
- Dow AgroSciences. 2000. Research Sample Safety Data Sheet. Product: XDE-638. Indianapolis, IN. Effective Date: 1/25/00.
- Dow AgroSciences. 2002a. Test Substance Distribution Certificate. Test Substance Number: TSN101980. Indianapolis, IN. Last Assay Date: 23 Apr 2001. Sampled by Kent Hensley 2-26-02.
- Dow AgroSciences. 2002b. Certificate of Analysis for Test/Reference/Control Substances. TSN101980. Indianapolis, IN. Study Completion Date: April 23, 2001.
- Environmental Canada. 1992 (Amended November 1997). Biological Test Method: Growth Inhibition Test using the Freshwater Alga *Selenastrum capricornutum*. Environment Canada Conservation and Protection. Ottawa, ON. EPS 1/RM/25.
- ESG International Standard Operating Procedures Manual (ESG). 2001a. SOP# 206. Standard Operating Procedure for the Laboratory Culture of *Selenastrum capricornutum*. ESG International Specialty Chemicals Division Standard Operating Procedures Manual.
- ESG International Standard Operating Procedures Manual (ESG). 2001b. SOP# 307. Standard Operating Procedure for Conducting Growth Inhibition Flask Tests Using *Selenastrum capricornutum*, *Skeletonema costatum*, *Anabaena flos-aquae* and *Navicula pelliculosa*. ESG International Specialty Chemicals Division Standard Operating Procedures Manual.
- ESG International Standard Operating Procedures Manual (ESG). 2001c. SOP# 12. Interpretation and Recording of Reference Toxicant Data. ESG International Specialty Chemicals Division Standard Operating Procedures Manual.
- Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). 1982. Pesticide Assessment Guidelines. Subdivision J. Hazard Evaluation: Nontarget Plants. By R.W. Holst and T.C. Ellwanger. Office of Pesticide Programs. Washington, D.C. 55 pp.
- Organization for Economic Cooperation and Development (OECD). 1984. Method #201, "Alga, Growth Inhibition Test". OECD Guidelines for Testing of Chemicals.
- Organization for Economic Cooperation and Development (OECD). 1998. The OECD Principles of Good Laboratory Practice. Environment Monograph No. 45. Environment Directorate, Paris, France.
- U.S. Environmental Protection Agency (U.S. EPA). 1996. Ecological Effects Test Guidelines. OPPTS 850.5400 Algal Toxicity, Tiers I and II. EPA 712-C-96-164.
- West, Inc., and D.D. Gulley, 1996. ToxstatTM 3.5, Computer software and instruction manual. Western Ecosystems Technology, Inc. Cheyenne, Wyoming.