**Data Evaluation Repot on the Photolysis of O-sulfamuron (IR5878) in Water**

PMRA Submission Number {.....} EPA MRID Number 46588509

Data Requirement: PMRA Data Code:
EPA DP Barcode: D319377
OECD Data Point:
EPA Guideline: 161-2

**Test material:**

Common name: O-Sulfamuron.

Chemical name:

IUPAC name: 1-(4,6-Dimethoxypyrimidin-2-yl)-3-[2-(dimethylcarbamoyl) phenylsulfamoyl]urea.

CAS name: 2-[[[[[(4,6-Dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl] amino]-*N,N*-dimethylbenzamide.

CAS No.: 213464-77-8.

Synonyms Orthosulfamuron, IR5878.

Smiles string: CN(C(=O)c1ccccc1NS(=O)(=O)NC(=O)Nc1nc(cc(n1)OC)OC)C (ISIS v2.3/Universal SMILES).
No EPI Suite, v3.12 SMILES String found as of 7/6/06.

**Primary Reviewer:** Leanne Ganser
**Cambridge Environmental**

**Signature:**
**Date:** 7/12/06

**Secondary Reviewer:** Kathleen Ferguson
**Cambridge Environmental**

**Signature:**
**Date:** 7/12/06

**QC/QA Manager**: Joan Gaidos
**Cambridge Environmental**

**Signature:**
**Date:** 7/12/06

**Final Reviewer:** Gregory Orrick
**EPA Reviewer**

**Signature:**
**Date:** 7/18/06 Greg Orrick

**Company Code:**
**Active Code:**
**Use Site Category:**
**EPA PC Code:** 108209

**CITATION:** Hennecke, D. 2002. Aquatic Photodegradation and Quantum Yield of IR5878. Unpublished study performed by Fraunhofer Institute for Molecular Biology and Applied Ecology, Schmallenberg, Germany; sponsored and submitted by ISAGRO S.p.A., Milan, Italy. GLP-Code: ISA-003/7-05. Experiment started July 26, 2002, and completed August 13, 2002. Final report issued November 8, 2002. 52 pp.

**Data Evaluation Repot on the photolysis of o-sulfamuron (IR5878) in water**

PMRA Submission Number {.....} EPA MRID Number 46588509

Data Requirement: PMRA Data Code:
EPA DP Barcode: D319377
OECD Data Point:
EPA Guideline: 161-2

**Test material:**

Common name: O-Sulfamuron.

Chemical name:

IUPAC name: 1-(4,6-Dimethoxypyrimidin-2-yl)-3-[2-(dimethylcarbamoyl) phenylsulfamoyl]urea.

CAS name: 2-[[[[[(4,6-Dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl] amino]-*N,N*-dimethylbenzamide.

CAS No.: 213464-77-8.

Synonyms Orthosulfamuron, IR5878.

Smiles string: CN(C(=O)c1ccccc1NS(=O)(=O)NC(=O)Nc1nc(cc(n1)OC)OC)C (ISIS v2.3/Universal SMILES).
No EPI Suite, v3.12 SMILES String found as of 7/6/06.

**Primary Reviewer:** Leanne Ganser
**Cambridge Environmental**

**Signature:** Leanne Ganser
**Date:** 7/12/06

**Secondary Reviewer:** Kathleen Ferguson
**Cambridge Environmental**

**Signature:** Kathleen Ferguson
**Date:** 7/12/06

**QC/QA Manager**: Joan Gaidos
**Cambridge Environmental**

**Signature:**
**Date:** 7/12/06

**Final Reviewer:** Gregory Orrick
**EPA Reviewer**

**Signature:**
**Date:**

**Company Code:**
**Active Code:**
**Use Site Category:**
**EPA PC Code:** 108209

**CITATION:** Hennecke, D. 2002. Aquatic photodegradation and quantum yield of IR5878. Unpublished study performed by Fraunhofer Institute for Molecular Biology and Applied Ecology, Schmallenberg, Germany; sponsored and submitted by ISAGRO S.p.A., Milan, Italy. GLP-Code: ISA-003/7-05. Experiment started July 26, 2002, and completed August 13, 2002 (p. 12). Final report issued November 8, 2002.

## EXECUTIVE SUMMARY

The aqueous phototransformation of unlabeled 1-(4,6-dimethoxypyrimidin-2-yl)-3-[2-(dimethylcarbamoyl) phenylsulfamoyl]urea (o-sulfamuron, purity 98.19%), at 10, 20 and 30 mg a.i./L, was studied in a pH 9 buffer (borate, molarity not reported) solution that was irradiated continuously using a filtered xenon lamp for 166 hours at 25°C. The nominal intensity of the lamp was 700 W/m$^2$; the actual intensity was quantified using an actinometer. This experiment was conducted in accordance with the EC Commission Directive 94/37/EC and the draft OECD guideline "Phototransformation of Chemicals in Water-Direct and Indirect Photolysis", and in compliance with OECD and German GLP standards. The test system consisted of cylindrical glass trays (21 mm diameter, 10 mL volume) containing treated buffer solution. Three trays of each concentration were placed in the irradiation chamber and covered with quartz glass plates and maintained at 25 ± 5°C using a circulator. The dark controls were kept in a darkened incubator. Replicate samples of each concentration were collected at 0, 2, 4, 8, 16, 24, 32, 40, 48, 64, 87.5, 120, 144, and 166 hours posttreatment; sampling may have been done by collecting aliquots of the bulk irradiated solutions. The test solutions were analyzed for o-sulfamuron and its transformation products by HPLC. Compounds were identified by comparison to the retention times of unlabeled reference standards of o-sulfamuron, DOP urea, DBS acid, DOR amine, and DB amine. Volatiles were not collected.

The temperature of the irradiated solutions was maintained at 25 ± 5°C and of the dark controls at 25°; no supporting data provided. The pH of the buffer solutions and the sterility of the samples were not reported.

A material balance was not determined. The test material was not radiolabeled, and the test solution was analyzed only for o-sulfamuron.

O-Sulfamuron was relatively stable in the irradiated solutions, declining 4.9-5.6% of the applied during *ca.* 7 days of continuous irradiation. O-Sulfamuron was stable in the dark controls. No transformation products were isolated from either the irradiated samples or dark controls. Volatiles were not collected.

Using first order linear regression analysis (Excel 2003), o-sulfamuron dissipated with calculated half-lives of 85, 87, and 98 days, applied at 10, 20, and 30 mg a.i./L, respectively, yielding a calculated half-life (combined data) of 90 days based on the continuous irradiation used in the study. These half-lives are of uncertain value since they are extrapolated well beyond the 6.9-day duration of the study.

Since o-sulfamuron was stable in the dark control, the **phototransformation half-life** of o-sulfamuron is 2,150 hours (*ca.* 90 days) based on the continuous irradiation used in the study. Based on a 12-hour light/12-hour dark cycle, the calculated phototransformation half-life of o-sulfamuron is **180 days** (*ca.* 6 months).

The **environmental phototransformation half-life** of o-sulfamuron could not be determined because the intensity of the artificial light was not compared to natural sunlight. Based on calculations using the quantum yield, the study author estimated an environmental phototransformation half-life of >6 months.

A transformation pathway was not provided and could not be developed since o-sulfamuron was relatively stable to photolysis and no transformation products were isolated.

The quantum yield of o-sulfamuron in pH 9 buffer was estimated to be an average of $1.56 \times 10^{-4} \pm 2.3 \times 10^{-5}$.

**Results Synopsis**

| pH 9 | Half-life | Transformation products | |
|---|---|---|---|
| | | Major | Minor |
| **10 mg a.i./L** | | | |
| Irradiated | 2,035 hours (84.8 days). | None. | None. |
| Dark | Stable. | None. | None. |
| **20 mg a.i./L** | | | |
| Irradiated | 2,089 hours (87.0 days). | None. | None. |
| Dark | Stable. | None. | None. |
| **30 mg a.i./L** | | | |
| Irradiated | 2,351 hours (98.0 days). | None. | None. |
| Dark | Stable. | None. | None. |
| **10, 20, 30 mg a.i./L (combined data)** | | | |
| Irradiated | 2,150 hours (89.6 days). | None. | None. |
| Dark | Stable. | None. | None. |

**Study Acceptability**: This study is classified as **supplemental**, as the study was terminated after *ca.* 7 days of continuous irradiation, at which time >94% of the applied o-sulfamuron remained undegraded. Furthermore, sterility was not confirmed, the intensity of the artificial light was not compared to natural sunlight, and raw sample concentration and temperature data were not reported.

## I. MATERIALS AND METHODS

**GUIDELINE FOLLOWED:** This study was conducted in accordance with the European Union Directive 94/37/EC, Section 2.9.2 and 2.9.3 (1994) and the draft OECD guideline "Phototransformation of Chemicals in Water-Direct and Indirect Photolysis" (2000, pp. 3, 4, 13). Significant deviations from the objectives of Subdivision N guidelines include:

The study was terminated after only 166 hours of continuous irradiation, at which time >94% of the applied o-sulfamuron remained undegraded. Subdivision N guidelines specify that a photodegradation study be conducted for 30 days (15 days if irradiation is continuous).

The artificial light intensity was not compared to natural sunlight, as specified by Subdivision N guidelines.

The sterility of the samples was not reported. Subdivision N guidelines specify that glassware should be sterilized to minimize the possibility of microbial degradation.

**COMPLIANCE:** This study was conducted in compliance with OECD (1997) and German GLP standards (2002; pp. 3, 4a, 4b, 13). Signed and dated Data Confidentiality, Certificate of Authenticity, GLP, and Quality Assurance statements were provided (pp. 2-4b, 10-11).

### A. MATERIALS:

**1. Test Material** O-Sulfamuron (unlabeled; p. 15).

**Chemical Structure:** See DER Attachment 1.

**Description:** Whitish powder, technical grade (p. 15).

**Purity:** Radiochemical purity: The test material was not radiolabeled (p. 15).
Lot No.: 20689/27.
Analytical purity: 98.19%.
Specific activity: Not Applicable.
Location of the radiolabel: Not applicable.

**Storage conditions of test chemicals:** The test material was stored at 4-6°C in the dark (p. 16).

**Physico-chemical Properties of O-sulfamuron:**

| Parameter | Value | Comment |
|---|---|---|
| Molecular weight (g/mol) | Not reported. | |
| Chemical formula | $C_{16}H_{20}N_6O_6S$. | |
| Water Solubility | 23.9 mg/L. | |
| Vapor Pressure/Volatility | Not reported. | |
| UV Absorption | 914.1 L-mol/cm at 290 nm; no significant adsorption above 400 nm. | |
| Pka | Not reported. | |
| $K_{ow}$/log $K_{ow}$ | Not reported. | |
| Stability of compound at room temperature. | Not reported. | |

Data obtained from pp. 15-16, 32-33; Attachment 1, Figure 4, p. 41; and Attachment 4, Table 12, pp. 45-46 in the study report.

## 2. Buffer Solution

The following buffer solution was prepared:

**Table 1: Description of buffer solutions.**

| pH | Type and molarity of buffer | Composition |
|---|---|---|
| 9 | Borate (Molarity not reported) | Prepared using Merck Titrisol ready-to-use buffer, which is comprised of boric acid, potassium chloride, and NaOH. |

Data obtained from pp. 23, 25 in the study report.

## 3. Details of light source

**Table 2: Artificial light source.**

| Property | Details |
|---|---|
| Nature of light source | Xenon lamp (Atlas/Hanau Suntest CPS+). |
| Emission wavelength spectrum | 290-800 nm. |
| Light intensity | Nominal 700 W/m$^2$; actual intensity measured using a p-nitroanisole/pyridine actinometer. |
| Filters used | Coated quartz and special UV glass. |
| Relationship to natural sunlight | The spectral energy distribution of the artificial light was reported to be comparable to the solar spectrum. A graphical representation of the wavelength distribution of only the artificial light is presented in Attachment 2, p. 42. A direct comparison of the intensity of the artificial light to sunlight was not provided by the study author. |

Data obtained from pp. 24-25 and 27, and Attachment 2, Figure 5, p. 42 in the study report.

## B. EXPERIMENTAL CONDITIONS:

**1. Preliminary Study:** In order to select the pH at which to conduct the study and to determine UV adsorbance, o-sulfamuron was dissolved in buffer solutions of pH 5, 7, and 9 (p. 24). The absorption of the buffer solutions was determined by UV/VIS. No significant differences were observed, so it was concluded that absorption was not dependent upon pH (Attachment 1, Figure 4, p. 41). The definitive study was conducted at pH 9 where hydrolytic stability was highest.

### 2. Experimental Conditions

**Table 3: Experimental Parameters.**

| Parameters | | Details |
|---|---|---|
| Duration of the study | | 166 hours. |
| Test concentrations (mg a.i./L)<br>Nominal:<br>Measured: | | <br>10, 20, 30<br>10.05, 19.78, 30.33 |
| Dark controls used (Yes/No) | | Yes. |
| Replication | Dark | Not reported; possibly three. For each concentration, bulk solutions were prepared and transferred to three sample vessels. The sample vessels appear to have been subsampled throughout the study. |
| | Irradiated | |
| Preparation of the test medium: | Volume used/treatment | Bulk solutions were prepared and transferred into individual sample vessels. |
| | Method of sterilization: | The treated buffer solution was filtered (<0.45 µm). |
| | Co-solvent, if any: | None, the test substance was dissolved in water. |
| Test apparatus (Type/Material/Volume) | | Irradiated: Cylindrical glass trays (10 mL volume, 21 mm diameter) containing treated buffer solution were placed in the irradiation chamber and covered with quartz glass plates. Every tray was stirred with a magnetic stirrer. The temperature was maintained at 25 ± 5°C using a circulating waterbath.<br>Dark: The dark controls were incubated in identical glass trays and kept in an incubator at 25°C. |
| Details of traps for volatile compounds, if any | | Volatiles were not trapped. |
| If no traps were used, is the test system closed/open | | Closed. |
| Is there any indication of the test material adsorbing to the walls of the test apparatus? | | No. |
| Experimental Conditions<br>Temperature;<br>Duration of light/darkness: | | <br>Irradiated: 25 ± 5°C; dark control: 25°C.<br>Continuous. |
| Other details, if any | | None. |

Data obtained from pp. 25, 26 and 35, and Table 4, p. 25 in the study report.

**3. Supplementary experiments:** To determine quantum yield, an actinometer consisting of p-nitroanisole/pyridine was prepared (p. 22). The p-nitroanisole/pyridine solutions were placed in cylindrical glass trays and irradiated with the test solutions (p. 25).

**4. Sampling**:

**Table 4: Sampling details.**

| Observations | Details |
|---|---|
| Sampling intervals for the parent/transformation products | 0, 2, 4, 8, 16, 24, 32, 40, 48, 64, 87.5, 120, 144 and 166 hours. |
| Sampling method | Three aliquots (50-100 µL) of the irradiated and dark controls were collected at all sampling intervals. |
| Method of sampling volatile compounds, if any | Volatiles were not collected. |
| Sampling intervals/times for:<br>Sterility check<br>pH measurement | <br>Not reported.<br>Not reported. |
| Sample storage before analysis, if any | Not reported. |
| Other observation, if any | None. |

Data obtained from pp. 25-26 and Table 6, p. 35 in the study report.

## C. ANALYTICAL METHODS:

**Extraction/clean up/concentration methods:** The samples were diluted before HPLC analysis, but were otherwise analyzed without modification (p. 21).

**Volatile residue determination:** Volatiles were not collected.

**Total $^{14}C$ measurement:** The test substance was not radiolabeled.

**Derivatization method, if used:** A derivatization method was not employed.

**Identification and quantification of parent compound:** Aliquots of each sample were analyzed by HPLC using the following operating conditions: ODS 3 Inertsil column (250 x 4.6 mm, 5 µm), a mobile phase gradient of (A) acetonitrile and (B) 0.004M $KH_2PO_4$ in water [percent A:B (v:v): 0-2 minutes, 30:70; 2-7 minutes, decreasing to 85:15; 7-10 minutes, 85:15; 10-12 minutes, increasing to 30:70; 12-18 minutes, hold at 30:70], flow rate 1.0 mL/minute; with UV detection (200-356 nm; pp. 20-21). O-Sulfamuron was identified by comparison to the relative retention time of the test substance (Rt *ca.* 9.7 minutes).

**Identification and quantification of transformation products:** Transformation products were separated and quantified using HPLC as described for the parent and were identified by comparison to the relative retention time of unlabeled reference standards of:

| Compound | Purity | Retention Time (minutes) |
|---|---|---|
| DOP urea | 99.77% | 6.4 |
| DBS acid | 100% | 3.1 |
| DOP amine | 98% | 6.6 |
| DB amine | 99.5% | 5.3 |

Data obtained from pp. 16-19 and 21 of the study report.

**Detection limits (LOD, LOQ) for the parent:** The limit of detection (LOD) for the HPLC method was 0.034 mg/mL (p. 21). The limit of quantification (LOQ) was 0.111 mg/L.

**Detection limits (LOD, LOQ) for the transformation:** LOD and LOQ values were identical to those for the parent.

## II. RESULTS AND DISCUSSION

**A. TEST CONDITIONS:** The temperature of the irradiated solutions was maintained at 25 ± 5°C and of the dark controls was 25°C; no supporting data provided (pp. 25-26). The pH of the buffer solutions and the sterility of the samples were not reported.

**B. MASS BALANCE:** A material balance was not determined. The test material was not radiolabeled, and the test solution was analyzed only for o-sulfamuron.

**Table 5: Phototransformation of O-sulfamuron, Expressed as Percentage of the Applied Radioactivity, in pH 9 Buffer.**

| Compound | | Sampling times (hours) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 2 | 4 | 8 | 16 | 24 | 32 | 40 | 48 | 64 | 87.5 | 120 | 144 | 166 |
| 10 mg a.i/L | | | | | | | | | | | | | | | |
| O-Sulfamuron | Irradiated | 100.0 | 94.7 | 100.7 | 102.5 | 99.7 | 101.1 | 102.1 | 100.5 | 99.4 | 98.4 | 100.4 | 95.6 | 94.4 | 94.8 |
| | Dark | | 95.1 | 98.9 | 103.1 | 113.7 | 103.1 | 101.3 | 102.4 | 101.3 | 104.1 | 103.7 | 102.8 | 101.5 | 101.5 |
| Transformation Products | Irradiated | No transformation products were detected. | | | | | | | | | | | | | |
| | Dark | | | | | | | | | | | | | | |
| $CO_2$ and volatile organics | Irradiated | Volatiles were not addressed. | | | | | | | | | | | | | |
| | Dark | | | | | | | | | | | | | | |
| Total recovery | Irradiated | Total recoveries were not determined; samples were analyzed only for o-sulfamuron. | | | | | | | | | | | | | |
| | Dark | | | | | | | | | | | | | | |
| 20 mg a.i/L | | | | | | | | | | | | | | | |
| O-Sulfamuron | Irradiated | 100.0 | 96.9 | 101.2 | 102.0 | 104.7 | 102.7 | 101.3 | 102.1 | 100.0 | 101.4 | 102.1 | 97.2 | 97.2 | 94.3 |
| | Dark | | 97.6 | 100.8 | 100.4 | 129.9 | 100.4 | 102.9 | 102.9 | 102.9 | 102.7 | 106.2 | 99.6 | 102.4 | 102.4 |
| Transformation Products | Irradiated | No transformation products were detected. | | | | | | | | | | | | | |
| | Dark | | | | | | | | | | | | | | |
| $CO_2$ and volatile organics | Irradiated | Volatiles were not addressed. | | | | | | | | | | | | | |
| | Dark | | | | | | | | | | | | | | |
| Total recovery | Irradiated | Total recoveries were not determined; samples were analyzed only for o-sulfamuron. | | | | | | | | | | | | | |
| | Dark | | | | | | | | | | | | | | |

**Data Evaluation Report on the Photolysis of O-sulfamuron (IR5878) in Water**

PMRA Submission Number {.....} EPA MRID Number 46588509

| Compound | | Sampling times (hours) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 2 | 4 | 8 | 16 | 24 | 32 | 40 | 48 | 64 | 87.5 | 120 | 144 | 166 |
| 30 mg a.i/L | | | | | | | | | | | | | | | |
| O-Sulfamuron | Irradiated | 100.0 | 98.2 | 100.6 | 100.6 | 100.2 | 99.9 | 99.0 | 99.1 | 97.9 | 99.1 | 100.3 | 96.5 | 95.1 | 95.2 |
| | Dark | | 98.0 | 99.0 | 103.1 | 107.0 | 103.1 | 101.5 | 101.5 | 101.5 | 100.8 | 102.6 | 102.7 | 100.1 | 100.1 |
| Transformation Products | Irradiated | No transformation products were detected. | | | | | | | | | | | | | |
| | Dark | | | | | | | | | | | | | | |
| $CO_2$ and volatile organics | Irradiated | Volatiles were not addressed. | | | | | | | | | | | | | |
| | Dark | | | | | | | | | | | | | | |
| Total recovery | Irradiated | Total recoveries were not determined; samples were analyzed only for o-sulfamuron. | | | | | | | | | | | | | |
| | Dark | | | | | | | | | | | | | | |

Data obtained from p. 25 and Table 6, p. 35, in the study report. Averaged concentration data were converted to percent of applied, as no raw concentration or percent of applied data were provided in the MRID (DER Attachment 2).

**C. TRANSFORMATION OF PARENT COMPOUND:** O-Sulfamuron was relatively stable in the irradiated solutions, declining 4.8-5.7% of the applied during *ca.* 7 days of continuous irradiation (p. 25; Table 6, p. 35; DER Attachment 2). O-Sulfamuron was stable in the dark controls.

In the irradiated solution treated at 10 mg a.i./L, o-sulfamuron ranged from 94.7 to 102.5% with no discernable pattern between 0 and 87.5 hours posttreatment, and from 94.4 to 95.6% between 120 and 166 hours (study termination). In the dark control, o-sulfamuron averaged 95.1% of the applied at 2 hours posttreatment and 101.5% at 166 hours posttreatment.

In the irradiated solution treated at 20 mg a.i./L, o-sulfamuron ranged from 96.9 to 104.7% with no discernable pattern between 0 and 87.5 hours posttreatment, averaged 97.2% at 120 to 144 hours, and 94.3% at 166 hours. In the dark control, o-sulfamuron averaged 97.6% of the applied at 2 hours posttreatment and 102.4% at 166 hours posttreatment.

In the irradiated solution treated at 30 mg a.i./L, o-sulfamuron ranged from 97.9 to 100.6% with no discernable pattern between 0 and 87.5 hours posttreatment, averaged 96.5% at 120 hours, and 95.1-95.2% at 166 hours. In the dark control, o-sulfamuron averaged 98.0% of the applied at 2 hours posttreatment and 100.1% at 166 hours posttreatment.

**HALF-LIFE/$DT_{50}$/$DT_{90}$:** Using first order linear regression analysis (Excel 2003), o-sulfamuron dissipated with calculated half-lives of 85, 87, and 98 days, applied at 10, 20, and 30 mg a.i./L, respectively, yielding a calculated half-life (combined data) of 90 days based on the continuous irradiation used in the study. These half-lives are of uncertain value since they are extrapolated well beyond the 6.9-day duration of the study. O-sulfamuron was stable in the dark controls.

**Half-lives/$DT_{50}$/$DT_{90}$**

| Treatment | First order linear | | | $DT_{50}$ (days) | $DT_{90}$ (days) |
|---|---|---|---|---|---|
| | Half-life (hours) | Regression equation | $r^2$ | | |
| **10 mg/L** | | | | | |
| Irradiated | 2,035 | y = -0.0003406x + 4.6119 | 0.4282 | --- | --- |
| Dark | Stable | | | --- | --- |
| **20 mg/L** | | | | | |
| Irradiated | 2,089 | y = -0.0003319x + 4.6248 | 0.4146 | --- | --- |
| Dark | Stable | | | --- | --- |
| **30 mg/L** | | | | | |
| Irradiated | 2,351 | y = -0.0002948x + 4.6079 | 0.6953 | --- | --- |
| Dark | Stable | | | --- | --- |
| **Combined** | | | | | |
| Irradiated | 2,150 | y = -0.0003224x + 4.6149 | 0.4398 | --- | --- |
| Dark | Stable | | | --- | --- |

Calculated using data obtained from p. 25 and Table 6, p. 35 in the study report (DER Attachment 2).

Since o-sulfamuron was stable in the dark control, the **phototransformation half-life** of o-sulfamuron is 2,150 hours (*ca.* 90 days) based on the continuous irradiation used in the study. Based on a 12-hour light/12-hour dark cycle, the calculated phototransformation half-life of o-sulfamuron is **180 days** (*ca.* 6 months).

The **environmental phototransformation half-life** of o-sulfamuron could not be determined because the intensity of the artificial light was not compared to natural sunlight. Based on calculations using the quantum yield, the study author estimated an environmental phototransformation half-life of >6 months.

**TRANSFORMATION PRODUCTS**: No transformation products were isolated from either the irradiated samples or dark controls (p. 34).

**VOLATIZATION:** Volatiles were not collected.

**TRANSFORMATION PATHWAY:** A transformation pathway was not provided. O-sulfamuron was relatively stable to photolysis; no transformation products were isolated (p. 34).

**D. SUPPLEMENTARY EXPERIMENT-RESULTS:** Based on the results of the study, the quantum yield of o-sulfamuron in pH 9 buffer was estimated to be an average of $1.56 \times 10^{-4} \pm 2.3 \times 10^{-5}$ (p. 37).



13

## III. STUDY DEFICIENCIES

1. The study was terminated after only 166 hours or *ca.* 6.9 days of continuous irradiation, at which time >94% of the initial o-sulfamuron remained undegraded. Subdivision N guidelines specify that a photodegradation study be conducted for 30 days (15 days if irradiation is continuous) or until the half-life of the parent is clearly established. Although the data suggest that the half-life of o-sulfamuron is >30 days, an additional 8 days of data would have provided greater confidence in the results from the half-life calculations.

2. Raw sample concentration data were not provided, nor were raw temperature data. Sample concentration data were reported as mean values of two parallel samples from up to three possible replicates. Raw data should be reported to confirm statistical calculations.

3. The study methods were poorly described. Three vessels of each concentration (nine total) plus three vessels containing the actinometer solution were placed in the irradiation apparatus at the same time. The volume of each vessel was 10 mL, but it was not certain that the vessel was completely filled. It could not be determined with any certainty whether each vessel was subsampled at each of the thirteen sampling intervals, whether random subsamples were collected (so that only duplicate samples were collected at each interval), or whether the experiment was repeated several times using different intervals and entire vessels were collected. The study author states that "...only 12 samples of the test solution could be irradiated simultaneously..." (p. 25) and also that data represent "...mean values of both parallel samples..." (Table 6, p. 35). "Parallel samples" may refer to irradiated vs dark control samples rather than replicate samples.

4. A direct comparison of the intensity of the artificial light to sunlight was not provided. Rather, several assumptions (water surface 100 $m^2$, depth 10 cm, zenith angle noon minus 1/6 of daylight; p. 32) and the quantum yield were used to predict the minimum, maximum and mean half-lives of o-sulfamuron at 52°N throughout the year (Table 10, p. 39). The half-life of o-sulfamuron in June was estimated to average 6.6 months, which is comparable to the photodegradation half-life.

5. The sterility of the samples was not reported. Subdivision N guidelines specify that the sterility of glassware should be confirmed to minimize the possibility of microbial degradation.

## IV. REVIEWER'S COMMENTS

1. The molarity of the buffer solution was not reported. A commercial ready-to-use borate buffer was used in the study.

2. The final sampling interval was reported to be as 160 hours (p. 26) in the text and 166 hours in the data table (Table 6, p. 35).

## V. REFERENCES

1. U.S. Environmental Protection Agency. 1982. Pesticide Assessment Guidelines, Subdivision N, Chemistry: Environmental Fate, Section 161-2. Photolysis studies. Office of Pesticide and Toxic Substances, Washington, DC. EPA 540/9-82-021.

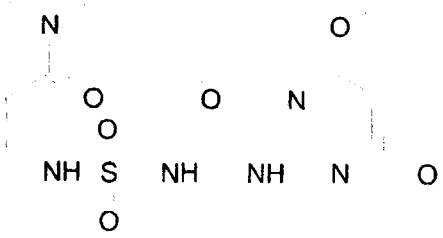
2. U.S. Environmental Protection Agency. 1989. FIFRA Accelerated Reregistration, Phase 3 Technical Guidance. Office of the Prevention, Pesticides, and Toxic Substances, Washington, DC. EPA 540/09-90-078.

3. U.S. Environmental Protection Agency. 1993. Pesticide Registration Rejection Rate Analysis - Environmental Fate. Office of the Prevention, Pesticides, and Toxic Substances, Washington, DC. EPA 738-R-93-010.

## Attachment 1: Structures of Parent Compound and Transformation Products

**Orthosulfamuron [IR5878; S3]**

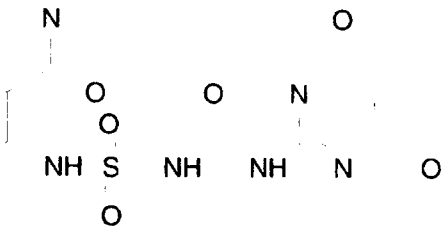
| | |
|---|---|
| **IUPAC Name:** | 1-(4,6-Dimethoxypyrimidin-2-yl)-3-[2-(dimethylcarbamoyl)phenylsulfamoyl]urea. |
| **CAS Name:** | 2-[[[[[(4,6-Dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]amino]-N,N-dimethylbenzamide. |
| **CAS Number:** | 213464-77-8. |
| **SMILES String:** | CN(C(=O)c1ccccc1NS(=O)(=O)NC(=O)Nc1nc(cc(n1)OC)OC)C (ISIS v2.3/Universal SMILES). No EPI Suite, v3.12 SMILES String found as of 7/6/06. |



**Identified Compounds**

**Orthosulfamuron [IR5878; S3]**

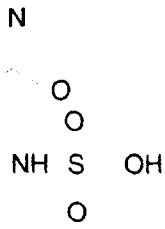
| | |
|---|---|
| **IUPAC Name:** | 1-(4,6-Dimethoxypyrimidin-2-yl)-3-[2-(dimethylcarbamoyl)phenylsulfamoyl]urea. |
| **CAS Name:** | 2-[[[[[(4,6-Dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]amino]-N,N-dimethylbenzamide. |
| **CAS Number:** | 213464-77-8. |
| **SMILES String:** | CN(C(=O)c1ccccc1NS(=O)(=O)NC(=O)Nc1nc(cc(n1)OC)OC)C (ISIS v2.3/Universal SMILES).<br>No EPI Suite, v3.12 SMILES String found as of 7/6/06. |



## Unidentified Reference Compounds

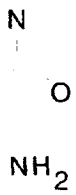
**DBS acid [IR7863; S1]**

**IUPAC Name:** (2-Dimethylcarbamoylphenyl)sulfamic acid.
**CAS Name:** Sodium (2-dimethylcarbamoylphenyl)sulfamate.
**CAS Number:** Not reported.



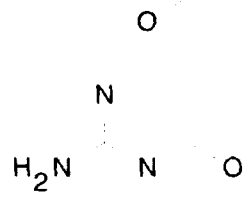
**DB amine [S4]**

**IUPAC Name:** 2-Amino-N,N-dimethylbenzamide.
**CAS Name:** Not reported.
**CAS Number:** Not reported.



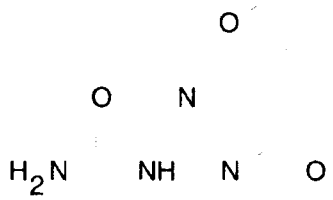
**DOP amine [S13]**

**IUPAC Name:** 4,6-Dimethoxypyrimidin-2-yl amine.
2-Amino-4,6-dimethoxypyrimidine.
**CAS Name:** Not reported.
**CAS Number:** Not reported.



**DOP urea [IR7825; S12]**

**IUPAC Name:** N-(4,6-Dimethoxypyrimidin-2-yl)-urea.
**CAS Name:** 4,6-Dimethoxy-2-pyrimidinyl urea.
**CAS Number:** Not reported.



**Attachment 2: Excel Spreadsheets**

**Chemical: O-sulfamuron**
**MRID: 46588509**
**PC Code: 108209**
**Guideline: 161-2**

**Phototransformation of o-sulfamuron in pH 9 buffer, expressed as mg a.i./L.**

| Irradiated Samples (mg/L) | | | |
|---|---|---|---|
| Irradiation time (hr) | Concentration (mg/L) | | |
| | 10 | 20 | 30 |
| 0 | 10.05 | 19.78 | 30.33 |
| 2 | 9.52 | 19.17 | 29.78 |
| 4 | 10.12 | 20.01 | 30.52 |
| 8 | 10.30 | 20.17 | 30.52 |
| 16 | 10.02 | 20.70 | 30.40 |
| 24 | 10.16 | 20.32 | 30.31 |
| 32 | 10.26 | 20.03 | 30.04 |
| 40 | 10.10 | 20.19 | 30.07 |
| 48 | 9.99 | 19.78 | 29.68 |
| 64 | 9.89 | 20.05 | 30.07 |
| 87.5 | 10.09 | 20.20 | 30.43 |
| 120 | 9.61 | 19.22 | 29.27 |
| 144 | 9.49 | 19.22 | 28.85 |
| 166 | 9.53 | 18.66 | 28.86 |

| Dark Controls (mg/L) | | | |
|---|---|---|---|
| irradiation time (hr) | Concentration (mg/L) | | |
| | 10 | 20 | 30 |
| 0 | 10.05 | 19.78 | 30.33 |
| 2 | 9.56 | 19.30 | 29.73 |
| 4 | 9.94 | 19.94 | 30.03 |
| 8 | 10.36 | 19.85 | 31.26 |
| 16 | 11.43 | 25.69 | 32.44 |
| 24 | 10.36 | 19.85 | 31.26 |
| 32 | 10.18 | 20.35 | 30.79 |
| 40 | 10.29 | 20.35 | 30.80 |
| 48 | 10.18 | 20.35 | 30.79 |
| 64 | 10.46 | 20.31 | 30.56 |
| 87.5 | 10.42 | 21.00 | 31.12 |
| 120 | 10.33 | 19.70 | 31.16 |
| 144 | 10.20 | 20.26 | 30.36 |
| 166 | 10.20 | 20.26 | 30.36 |

Data obtained from p. 25 and Table 6, p. 35 of study report. Only mean values reported by study author.

**Phototransformation of o-sulfamuron in pH 9 buffer, expressed as % initial radioactivity.**

| Irradiated Samples (% of initial) | | | |
|---|---|---|---|
| Irradiation time (hr) | Concentration (mg/L) | | |
| | 10 | 20 | 30 |
| 0 | 100.0 | 100.0 | 100.0 |
| 2 | 94.7 | 96.9 | 98.2 |
| 4 | 100.7 | 101.2 | 100.6 |
| 8 | 102.5 | 102.0 | 100.6 |
| 16 | 99.7 | 104.7 | 100.2 |
| 24 | 101.1 | 102.7 | 99.9 |
| 32 | 102.1 | 101.3 | 99.0 |
| 40 | 100.5 | 102.1 | 99.1 |
| 48 | 99.4 | 100.0 | 97.9 |
| 64 | 98.4 | 101.4 | 99.1 |
| 87.5 | 100.4 | 102.1 | 100.3 |
| 120 | 95.6 | 97.2 | 96.5 |
| 144 | 94.4 | 97.2 | 95.1 |
| 166 | 94.8 | 94.3 | 95.2 |

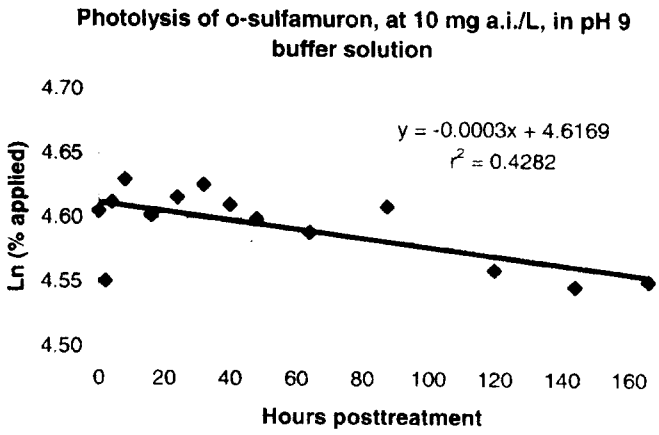
| Dark Controls (% of initial) | | | |
|---|---|---|---|
| irradiation time (hr) | Concentration (mg/L) | | |
| | 10 | 20 | 30 |
| 0 | 100.0 | 100.0 | 100.0 |
| 2 | 95.1 | 97.6 | 98.0 |
| 4 | 98.9 | 100.8 | 99.0 |
| 8 | 103.1 | 100.4 | 103.1 |
| 16 | 113.7 | 129.9 | 107.0 |
| 24 | 103.1 | 100.4 | 103.1 |
| 32 | 101.3 | 102.9 | 101.5 |
| 40 | 102.4 | 102.9 | 101.5 |
| 48 | 101.3 | 102.9 | 101.5 |
| 64 | 104.1 | 102.7 | 100.8 |
| 87.5 | 103.7 | 106.2 | 102.6 |
| 120 | 102.8 | 99.6 | 102.7 |
| 144 | 101.5 | 102.4 | 100.1 |
| 166 | 101.5 | 102.4 | 100.1 |

**Chemical:** **O-sulfamuron**
**PC Code:** **108209**
**MRID:** **46588509**
**Guideline** **161-2**

**Irradiated, 10 mg a.i./L**

Half life (hours): **2035.1** (84.8 days)

| Hours posttreatment | O-sulfamuron % applied | Ln (% applied) |
|---|---|---|
| 0 | 100.0 | 4.6052 |
| 2 | 94.7 | 4.5510 |
| 4 | 100.7 | 4.6121 |
| 8 | 102.5 | 4.6297 |
| 16 | 99.7 | 4.6022 |
| 24 | 101.1 | 4.6161 |
| 32 | 102.1 | 4.6259 |
| 40 | 100.5 | 4.6101 |
| 48 | 99.4 | 4.5992 |
| 64 | 98.4 | 4.5891 |
| 87.5 | 100.4 | 4.6091 |
| 120 | 95.6 | 4.5604 |
| 144 | 94.4 | 4.5478 |
| 166 | 94.8 | 4.5520 |




Data obtained from p. 25 and Table 6, p. 35 of the study report and DER Attachment 2.

SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.654386872 |
| R Square | 0.428222179 |
| Adjusted R Squ | 0.380574027 |
| Standard Error | 0.022585582 |
| Observations | 14 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *ignificance F* |
|---|---|---|---|---|---|
| Regression | 1 | 0.004584433 | 0.004584 | 8.987173 | 0.011111 |
| Residual | 12 | 0.006121302 | 0.00051 | | |
| Total | 13 | 0.010705736 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *ower 95.0%* | *Jpper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 4.611948904 | 0.008603883 | 536.0311 | 1.2E-27 | 4.593203 | 4.630695 | 4.593203 | 4.630695 |
| X Variable 1 | -0.0003406 | 0.000113614 | -2.997861 | 0.011111 | -0.000588 | -9.31E-05 | -0.000588 | -9.31E-05 |

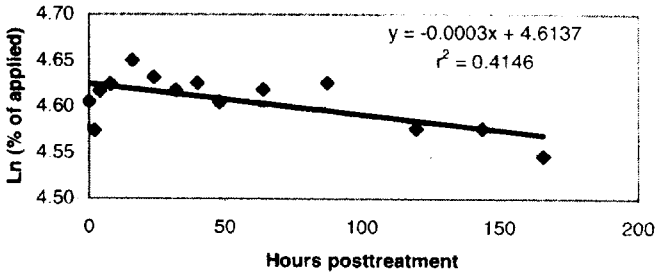
**Chemical:** **O-sulfamuron**
**PC Code:** **108209**
**MRID:** **46588509**
**Guideline** **161-2**

**Irradiated, 20 mg a.i./L**

Half life (hours) **2088.6** (87.0 days)

| Hours posttreatment | O-sulfamuron % applied | Ln (% applied) |
|---|---|---|
| 0 | 100 | 4.6052 |
| 2 | 96.9 | 4.5738 |
| 4 | 101.2 | 4.6167 |
| 8 | 102.0 | 4.6247 |
| 16 | 104.7 | 4.6506 |
| 24 | 102.7 | 4.6321 |
| 32 | 101.3 | 4.6177 |
| 40 | 102.1 | 4.6257 |
| 48 | 100.0 | 4.6052 |
| 64 | 101.4 | 4.6187 |
| 87.5 | 102.1 | 4.6262 |
| 120 | 97.2 | 4.5765 |
| 144 | 97.2 | 4.5765 |
| 166 | 94.3 | 4.5469 |

**Photolysis of o-sulfamuron, at 20 mg a.i./L, in pH 9 buffer solution**




Data obtained from p. 25 and Table 6, p. 35 of the study report and DER Attachment 2.

SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.643880365 |
| R Square | 0.414581924 |
| Adjusted R Squ | 0.365797084 |
| Standard Error | 0.022630848 |
| Observations | 14 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *ignificance F* |
|---|---|---|---|---|---|
| Regression | 1 | 0.004352383 | 0.004352 | 8.498171 | 0.012956 |
| Residual | 12 | 0.006145863 | 0.000512 | | |
| Total | 13 | 0.010498247 | | | |

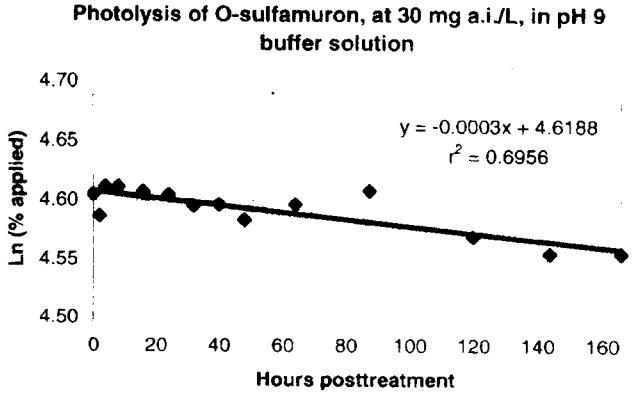
| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *ower 95.0%* | *Jpper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 4.62479874 | 0.008621127 | 536.4494 | 1.19E-27 | 4.606015 | 4.643583 | 4.606015 | 4.643583 |
| X Variable 1 | -0.000331868 | 0.000113842 | -2.915162 | 0.012956 | -0.00058 | -8.38E-05 | -0.00058 | -8.38E-05 |

**Chemical:** **O-sulfamuron**
**PC Code:** **108209**
**MRID:** **46588509**
**Guideline** **161-2**

**Irradiated, 30 mg a.i./L**

Half life (hours) **2351.1** (98.0 days)

| Hours posttreatment | O-sulfamuron % applied | Ln (% applied) |
|---|---|---|
| 0 | 100 | 4.6052 |
| 2 | 98.2 | 4.5869 |
| 4 | 100.6 | 4.6114 |
| 8 | 100.6 | 4.6114 |
| 16 | 100.2 | 4.6075 |
| 24 | 99.9 | 4.6045 |
| 32 | 99.0 | 4.5956 |
| 40 | 99.1 | 4.5966 |
| 48 | 97.9 | 4.5835 |
| 64 | 99.1 | 4.5966 |
| 87.5 | 100.3 | 4.6085 |
| 120 | 96.5 | 4.5696 |
| 144 | 95.1 | 4.5551 |
| 166 | 95.2 | 4.5555 |




Data obtained from p. 25 and Table 6, p. 35 of the study report and DER Attachment 2.

SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.833821663 |
| R Square | 0.695258566 |
| Adjusted R Squ | 0.669863446 |
| Standard Error | 0.011201102 |
| Observations | 14 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *ignificance F* |
|---|---|---|---|---|---|
| Regression | 1 | 0.003434928 | 0.003435 | 27.37764 | 0.00021 |
| Residual | 12 | 0.001505576 | 0.000125 | | |
| Total | 13 | 0.004940504 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *ower 95.0%* | *Jpper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 4.60789108 | 0.004267013 | 1079.887 | 2.68E-31 | 4.598594 | 4.617188 | 4.598594 | 4.617188 |
| X Variable 1 | -0.000294822 | 5.63459E-05 | -5.232365 | 0.00021 | -0.000418 | -0.000172 | -0.000418 | -0.000172 |

**Chemical:** **O-sulfamuron**
**PC Code:** **108209**
**MRID:** **46588509**
**Guideline** **161-2**

**Irradiated, 10, 20 and 30 mg a.i./L**

Half life (hours): **2149.8** (89.6 days)

| Hours posttreatment | O-sulfamuron % applied | Ln (% applied) |
|---|---|---|
| 0 | 100.0 | 4.6052 |
| 2 | 94.7 | 4.5510 |
| 4 | 100.7 | 4.6121 |
| 8 | 102.5 | 4.6297 |
| 16 | 99.7 | 4.6022 |
| 24 | 101.1 | 4.6161 |
| 32 | 102.1 | 4.6259 |
| 40 | 100.5 | 4.6101 |
| 48 | 99.4 | 4.5992 |
| 64 | 98.4 | 4.5891 |
| 87.5 | 100.4 | 4.6091 |
| 120 | 95.6 | 4.5604 |
| 144 | 94.4 | 4.5478 |
| 166 | 94.8 | 4.5520 |
| 0 | 100.0 | 4.6052 |
| 2 | 96.9 | 4.5738 |
| 4 | 101.2 | 4.6167 |
| 8 | 102.0 | 4.6247 |
| 16 | 104.7 | 4.6506 |
| 24 | 102.7 | 4.6321 |
| 32 | 101.3 | 4.6177 |
| 40 | 102.1 | 4.6257 |
| 48 | 100.0 | 4.6052 |
| 64 | 101.4 | 4.6187 |
| 87.5 | 102.1 | 4.6262 |
| 120 | 97.2 | 4.5765 |
| 144 | 97.2 | 4.5765 |
| 166 | 94.3 | 4.5469 |
| 0 | 100.0 | 4.6052 |
| 2 | 98.2 | 4.5869 |
| 4 | 100.6 | 4.6114 |
| 8 | 100.6 | 4.6114 |
| 16 | 100.2 | 4.6075 |
| 24 | 99.9 | 4.6045 |
| 32 | 99.0 | 4.5956 |
| 40 | 99.1 | 4.5966 |
| 48 | 97.9 | 4.5835 |
| 64 | 99.1 | 4.5966 |
| 87.5 | 100.3 | 4.6085 |
| 120 | 96.5 | 4.5696 |
| 144 | 95.1 | 4.5551 |
| 166 | 95.2 | 4.5555 |

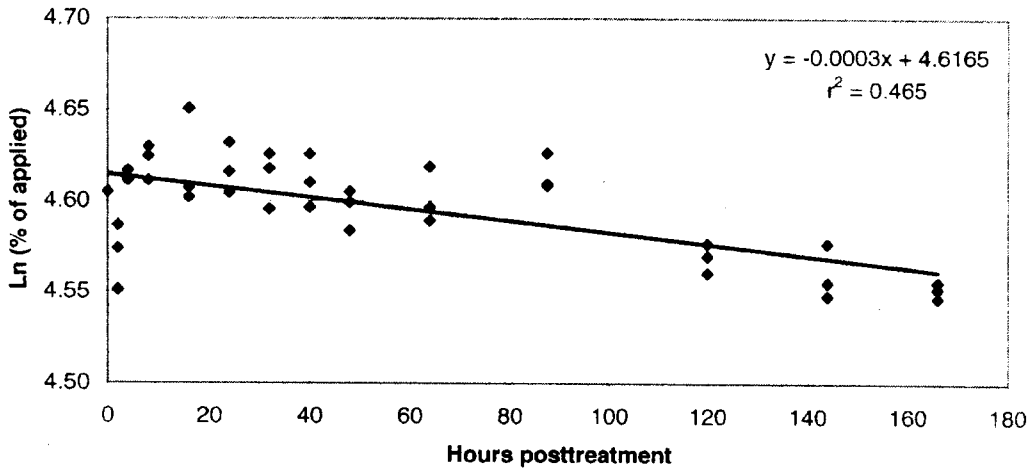
Data obtained from p. 25 and Table 6, p. 35 of the study report and DER Attachment 2.

**Chemical:** **O-sulfamuron**
**PC Code:** **108209**
**MRID:** **46588509**
**Guideline** **161-2**

**Irradiated, 10, 20 and 30 mg a.i./L**

Half life (hours): **2149.8** (89.6 days)

**Photolysis of o-sulfamuron, at 10-30 mg a.i./L, in pH 9 buffer**




SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.663205562 |
| R Square | 0.439841617 |
| Adjusted R Squa | 0.425837658 |
| Standard Error | 0.01980942 |
| Observations | 42 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 1 | 0.012325058 | 0.012325 | 31.40837527 | 1.69993E-06 |
| Residual | 40 | 0.015696524 | 0.000392 | | |
| Total | 41 | 0.028021582 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *ower 95.0%* | *Jpper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 4.614879575 | 0.004356867 | 1059.22 | 1.37928E-90 | 4.606074017 | 4.623685 | 4.606074 | 4.623685 |
| X Variable 1 | -0.00032243 | 5.75324E-05 | -5.604318 | 1.69993E-06 | -0.000438707 | -0.000206 | -0.000439 | -0.000206 |

**Attachment 3: Comparison of Artificial Light to Natural Sunlight**

DER for MRID # 46588509

Page 31 is not included in this copy.

Pages _____ through _____ are not included in this copy.

---

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

__✓__ FIFRA registration data.

_____ The document is a duplicate of page(s) _____.

_____ The document is not responsive to the request.

_____ Internal deliberative information.

_____ Attorney-Client work product.

_____ Claimed Confidential by submitter upon submission to the Agency.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

---