

US EPA ARCHIVE DOCUMENT

6/24/1992

MRID No. 420327-03

DATA EVALUATION RECORD

1. **CHEMICAL:** Silver Zeolite.
Shaughnessey No. none listed.
2. **TEST MATERIAL:** Silver Zeolite; 99% silver zeolite, 4 ±1% silver; a white powder.
3. **STUDY TYPE:** Freshwater Invertebrate Flow-Through Acute Toxicity Test. Species Tested: *Daphnia magna*.
4. **CITATION:** Ward, T.J. and R.L. Boeri. 1991. Acute Flow-Through Toxicity of Silver Zeolite to the Daphnid, *Daphnia magna*. EnviroSystems Study No. 90185-ADL. Prepared by EnviroSystems Division, Resource Analysts, Inc., Hampton, NH. Submitted by Kanebo Zeolite USA, Inc. EPA MRID No. 420327-03.
5. **REVIEWED BY:**

Mark A. Mossler, M.S. Associate Scientist KBN Engineering and Applied Sciences, Inc.	Signature: <i>Mark Mossler</i> Date: <i>1/7/92</i>
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6. **APPROVED BY:**

Pim Kosalwat, Ph.D. Senior Scientist KBN Engineering and Applied Sciences, Inc.	Signature: <i>P. Kosalwat</i> Date: <i>1/9/92</i>
Henry T. Craven, M.S. Supervisor, EEB/EFED USEPA	Signature: <i>Henry Craven</i> Date: <i>6/24/92</i>
7. **CONCLUSIONS:** This study is scientifically sound and may be used for assessing the environmental impact of silver zeolite, but not the active ingredient (silver). The EC₅₀ for silver zeolite was 0.035 mg/l (based on measured concentrations of silver back-calculated to mg/l of silver zeolite). The NOEC was estimated to be 0.013 mg/l (based on measured concentration of silver back-calculated to mg/l of silver zeolite). The EC value classifies this material as very highly toxic to daphnids.

9. BACKGROUND:**10. DISCUSSION OF INDIVIDUAL TESTS: N/A.****11. MATERIALS AND METHODS:**

- A. Test Animals:** *Daphnia magna* (less than 24 hours old) were reared in-house and collected from a single source. The daphnids were free from disease, injuries, and abnormalities at the beginning of the test.
- B. Test System:** An intermittent-flow proportional diluter delivered test solution or control water to individual 19.6-l glass aquaria (20-cm wide by 40-cm long by 25-cm deep) containing 15 l of test solution or control water (water depth of approximately 18 cm). All parts of the diluter in contact with the test solutions were made of glass or Teflon®. The volume of each aquarium was replaced an average of 8.1 times every 24 hours. The daphnids were housed in cages (glass cylinders with Nitex® screening) suspended in the test aquaria which were randomly positioned in a temperature-controlled water bath set at 20 ±1°C. The system was maintained on a 16-hour light/8-hour dark photoperiod under cool-white fluorescent light with an intensity of 12 $\mu\text{Es}^{-1}\text{m}^{-2}$.
- The test dilution water was well water collected in Hampton, NH. Water was adjusted to a hardness of 160 mg as CaCO_3 and stored in polyethylene tanks where it was aerated. The pH of the water was 7.4.
- A 1,200 mg/l stock was prepared in deionized water and appropriate amounts of this stock were added directly to dilution water by the diluter and mixed before delivery.
- C. Dosage:** Forty-eight-hour, flow-through, acute toxicity test. Based on a preliminary test, five nominal concentrations (0.06, 0.10, 0.16, 0.24, and 0.40 mg/l of silver zeolite), and a dilution water control were used. The concentrations made were corrected for the percent purity of the test material (99%).
- D. Design:** Twenty daphnids were randomly distributed among two replicates of each treatment. The loading during the test was <0.5 g/l. Daphnids were not fed and the test containers were not aerated.

Observations of mortality and sublethal responses (immobilization, erratic swimming, loss of reflex, excitability, discoloration, or change in behavior) were recorded initially and every 24 hours. Dead organisms were removed from the containers when observed. The temperature, dissolved oxygen (D.O.), conductivity, and pH were measured daily in each test chamber containing live daphnids. The temperature in one vessel was recorded continuously during the study.

Silver concentrations were measured using atomic absorption spectrophotometry on pooled samples from each test concentration. Samples were collected at 0 and 48 hours.

- E. **Statistics:** Median lethal (LC_{50}) and effective (EC_{50}) concentrations were calculated by the binomial method, moving average angle analysis, or probit analysis using nominal concentrations of test material. The no-observed-effect concentration (NOEC) was the test concentration that allowed at least 90% survival of exposed test organisms and does not cause sublethal effects.

12. **REPORTED RESULTS:** During the test, conductivity ranged between 720 and 760 $\mu\text{mho/cm}$. The pH ranged between 7.4 and 7.7. Temperatures ranged between 19.8 and 20.9°C. Dissolved oxygen ranged from 9.1 to 9.5 mg/l (99-103% of saturation).

"No observations of insoluble material in test vessels were recorded in test vessels during the study." Measured concentrations of silver were generally only slightly above the detection limit (0.0002 mg/l) and were not in agreement with nominal values (Table 2, attached). The measured values ranged from 14 to 26% of nominal concentrations.

One hundred percent survival was observed in the control exposure (Table 3, attached). The LC_{50} and EC_{50} values calculated with nominal and measured values of silver zeolite are presented in Table 4 (attached). The 48-hour LC_{50} and EC_{50} were 0.28 and 0.22 mg/l, respectively, based on measured concentrations of silver. The 48-hour NOEC was 0.10 mg/l based on nominal concentration of total product.

13. **STUDY AUTHOR'S CONCLUSIONS/QUALITY ASSURANCE MEASURES:** The authors presented no conclusions except those previously noted.

Quality Assurance and Good Laboratory Practice Compliance statements were included in the report, indicating that the study was conducted in accordance with FIFRA Good Laboratory Practice Standards set forth in 40 CFR Part 160.

14. REVIEWER'S DISCUSSION AND INTERPRETATION OF STUDY RESULTS:

- A. Test Procedure:** The test procedures were generally in accordance with protocols recommended by the guidelines, but deviated from the SEP as follows:

The test material was not identified by lot or batch number.

A 30-minute dawn and dusk simulation was not used.

The amount of time between test solution preparation and daphnid addition was not stated.

Alkalinity was not measured.

The dissolved oxygen concentration was occasionally higher than 100% saturation.

- B. Statistical Analysis:** The authors stated that the measured concentrations of silver were not in agreement with the nominal concentrations of silver zeolite. The reviewer back-calculated the mean measured concentrations of dissolved silver in terms of total product and found that the concentration of silver was proportional to the concentration of total product. Therefore, the reviewer used computer programs to analyze the data and calculate the EC_{50} value based on measured concentration of silver back-calculated to mg/l of total silver zeolite. The 48-hour EC_{50} and 95% confidence interval were 0.035 mg/l and 0.030-0.041 mg/l, respectively. The NOEC (based on lack of mortality and sublethal effects) was 0.013 mg/l, based on back-calculated concentration.

- C. Discussion/Results:** The authors stated that two replications of each concentration were conducted. Because the cages were inside of one aquarium, these duplications were not true replicates. Furthermore, reporting an LC_{50} and EC_{50} based on nominal concentrations is not acceptable since this is a flow-through test.

the inherently low solubility of this metal. However, these data are useful in assessing the potential environmental impact of the total product. If the toxicological properties of silver are desired, it should be tested separately.

This study is scientifically sound. The EC₅₀ for silver zeolite was 0.035 mg/l (based on measured concentrations of silver back-calculated to mg/l of silver zeolite). The NOEC was estimated to be 0.013 mg/l (based on measured concentration of silver back-calculated to mg/l of silver zeolite).

D. Adequacy of the Study:

(1) Core for silver zeolite

(2) Rationale: The data is useful in assessing the potential environmental risk of silver zeolite, but not the active ingredient silver.

(3) Repairability: N/A

15. **COMPLETION OF ONE-LINER FOR STUDY:** Yes, 12-9-91.

Silver Zeolite OER

Page ___ is not included in this copy.

Pages 6 through 8 are not included in this copy.

The material not included contains the following type of information:

- Identity of product inert ingredients.
- Identity of product inert 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.

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.

MOSSLER SILVER ZEOLITE DAPHNIA MAGNA 12-9-91

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD EFFECTED	BINOMIAL PROB. (PERCENT)
.058	20	20	100	9.536742E-05
.045	20	8	40	25.17223
.025	20	4	20	.5908966
.02	20	2	10	2.012253E-02
.013	20	0	0	9.536742E-05

THE BINOMIAL TEST SHOWS THAT .025 AND .058 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE ^{EC50} ~~EC50~~ FOR THIS SET OF DATA IS 4.644307E-02

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	EC50 ^{EC50}	95 PERCENT CONFIDENCE LIMITS	
4	6.099408E-02	3.466336E-02	3.033961E-02	4.071522E-02

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
4	.9473455	3.395981	1.703405E-02

SINCE THE PROBABILITY IS LESS THAN 0.05, RESULTS CALCULATED USING THE PROBIT METHOD PROBABLY SHOULD NOT BE USED.

SLOPE = 5.38291
95 PERCENT CONFIDENCE LIMITS = .1436334 AND 10.62219

^{EC50} LC50 = 3.804074E-02
95 PERCENT CONFIDENCE LIMITS = 1.417884E-02 AND 1.189729

LC10 = 2.209617E-02
95 PERCENT CONFIDENCE LIMITS = 5.475513E-10 AND 3.366372E-02

Raw data from Tables 2 + 3 (Attached)