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

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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM:

SUBJECT: Zinc Omadine Environmental Fate Science Review

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DP Barcode: 228349

Pesticide Chemical No.: 088002

EPA MRID: 438646-02, 440115-01, 440104-01,02,03, 438646-03,

Review Time: 30 days

ADMINISRTATIVE:

The registrant satisfied all environmental fate data requirements for the registration of zinc omadine with the exception of the anaerobic aquatic sediment metabolism data. The anaerobic aquatic metabolism data may be upgraded to acceptable with additional data.

In a telephone conversation on September 5, 1997 with Diane Petracelli and Patricia Turley of Olin Chemicals Research, the registrant was notified of the need to upgrade the anaerobic aquatic metabolism data. The anaerobic aquatic metabolism data is very important in assessing the fate of zinc omadine adsorbed to sediments at high depths where lack of oxygen and sunlight prevails. It is essential to know whether zinc omadine can persist in bottom sediments and be bioavailable to bottom feeding organisms. Indications are that under anaerobic aquatic conditions, zinc omadine will not persist. The telephone conversation revealed that Olin has additional data on the anaerobic aquatic metabolism of zinc omadine, as well as, on a related compound copper omadine. They claim that the anaerobic aquatic metabolism data on copper omadine is of higher quality than the data on zinc omadine and will address questions raised with respect to zinc omadine.

ENVIRONMENTAL FATE ASSESSMENT OF ZINC OMADINE.

The environmental fate of zinc omadine takes into consideration leach rate from paints that may reach 18 ug/cm^2/day, though lower leach rates were observed with other paints.

In general, it appears that zinc omadine is not likely to persist and accumulate in the water phase, although it is stable in pure sterile water, not exposed to sunlight, at all environmental pH. Since zinc omadine has a high adsorption coefficient to sediments (though lower adsorption than TBT) and low desorption, it is likely to be adsorbed to sediments. Trans metallation (with metals present in the sediment) to form complexes, such as copper omadine, of even higher adsorption coefficient are likely to reduce the aqueous availability even further. Zinc omadine should degrade rapidly (half life 15 days) in sediments under aerobic coditions as demonstrated by the aerobic aquatic metabolism study..

In the aerobic aquatic metabolism study only 6.6% of the zinc omadine was found in the water on day 0 due to trans metalation and adsorption to the sediment. In the upper portion of the water and in shallow rivers and lakes, where sunlight penetration and aerobic conditions exists, degradation of zinc omadine should prevail. Zinc omadine photodegrades rapidly when exposed to sunlight. In addition, the aerobic aquatic metabolism study indicated that zinc omadine is not likely to persist under aerobic conditions having a degradation half life of about 15 days in water/sediment. Degradation

under aerobic conditions resulted in 14 products of which omadine disulfide was clearly the major metabolite. Further oxidation led to sulfur oxidation products in the fresh water the aromatic ring cleavage led to the formation of 11.9% carbon dioxide after 30 days. Mineralization was essentially non existent in the salt water experiment.

In the absence of good anaerobic aquatic metabolism study (the study is unacceptable at this point) it is difficult to assess the stability of zinc omadine when adsorbed to sediments at high depths where sunlight penetration and oxygen are lacking.

The environmental fate assessment of Zinc Omadine is based on the studies submitted to the Antimicrobial Division to support the 40 CFR &158 requirements for registration. These studies include 161-1 Hydrolysis, 161-2 Photodegradation in Water, 162-3 Aerobic Aquatic Metabolism, 162-4 Anaerobic Aquatic Metabolism, 163-1 Adsorption/Desorption and 166-1 Release Rate from three Antifoulant Paints. Additional data to be used in the environmental fate assessment include product chemistry data such as the chemical structure of zinc omadine and its impurities/degradates, chemical characteristics such as pH, and physical properties such as solubility in water and organic solvents.

The following data requirements have been satisfied to date and a summary of each acceptable guideline study results is listed below:

161-1 Hydrolysis (MRID 438646-02, Hydrolysis of (pyridine -2-6- 14C) Zinc Omadine by J.L Reynolds

The study satisfies the hydrolysis data requirements.

The general conclusion drawn from the study is that zinc omadine is moderately stable in sterile waters of various pH when protected from sunlight. Degradation (hydrolysis) of zinc omadine in sterile salt water of pH 8.2 and in sterile fresh water of pH 5, 7 and 9 proceeded very slowly with calculated half lives of 96, 99, 120 and 123 days, respectively.

161-2 Photodegradation in Water (MRID 440115-01) Aqueous Photolysis of (pyridine-2-6-14C) Zinc Omadine in pH 9 Buffer and Artificial Sea Water by J.L Reynolds.

The study satisfies the photodegradation in water data requirement.

The general conclusion drawn from the study is that photodegradation is a very important mode of degradation for zinc omadine. Zinc omadine degraded rapidly when exposed to sunlight with calculated half life of less than 20 minutes in sterile water of pH 9 and in sea water of pH 8.2. A total of 14 degradates were formed (none over 10% of the applied) and recoveries of radiolabeled material were excellent.

162-3 Aerobic Aquatic Metabolism (MRID 440104-01) Aerobic Aquatic Metabolism of (pyridine-2-6-14C) Zinc Omadine by J.C. Ritter

The study satisfies the aerobic aquatic metabolism data requirements.

The general conclusion drawn from this study is that the availability of zinc omadine in both sea salt water and fresh water is reduced significantly by the formation of omadine salts of lower solubility than zinc omadine, such as Cu(II) omadine, adsorption to sediment and degradation. Therefore, less than 6.6% of the applied zinc omadine was present in the water phase at time 0 and thereafter. A rapid initial decline of zinc omadine in water was observed and on day 1, less than half of the zinc omadine could be recovered. Further decline of zinc omadine was observed with a half life of 12.4 and 15.2 days in the fresh and sea water, respectively. Mineralization to carbon dioxide was essentially present only in the fresh water reaching 11.9% after 30 days.

The major metabolites of zinc omadine were omadine disulfide omadine sulfinic acid, omadine sulfonic acid, and various unsymmetrical disulfides. Omadine disulfide, the major metabolite, reached a maximum level at the seven day interval in both studies with a value of 16.9% for the fresh water and 33.2% for the salt water.

The amount of zinc omadine in the water fraction after 30 days was less than 1% of the applied in both the fresh water and the seawater. The amount of zinc omadine in the salt water sediment declined from 48.6% on day 1 to 36.8% on day 3, 29% on day 7, 19% on day 14, 20.4% on day 21 and 15.3% on day 30. In the fresh water, the amount of zinc omadine in the sediment was 33.2% on day 1, 21.1% on day 3, 14.7% on day 7, 17.1% on day 14, 8.4% on day 21 and 7.6% on day 30.

Generation of carbon dioxide was substantially higher at the fresh water reaching 11.9% at day 30. On the other hand only 0.1% carbon dioxide was generated by day 30 in the salt water.

Total recoveries averaged over 90% (90-112%) in all sampling intervals.

163-1 Adsorption/Desorption (MRID 440104-02) Adsorption and Desorption of (pyridine-2-6-14C) Zinc Omadine in Two Sediments and Two terrestrial soils by M.L. Wisocky and J.L. Reynolds.

This study satisfies the adsorption/desorption data requirement for zinc omadine.

The general conclusion drawn from the study is that zinc omadine can be expected to have low mobility in salt water and seawater sediments and high adsorption/low desorption in sediments since all Kd ads and Kd des were above 48. Zinc Omadine can be characterized as slightly mobile in terrestrial soils with Kd ad/des values above 11.

Kd ads were 48 (n=.95) and 98 (n=.78) and Kd des were 87 (n=1) and 202 (.78) for the fresh and the salt water sediments, respectively.

Kd ads were 11 (n=1) and 50 (n=1) and Kd des were 13 (n=1) and 71 (n=1) for the fresh

and the salt water terrestrial soils, respectively.

166-1 Release Rate from paint (MRID 438646-03) Release Rate of Omadine from three Antifouling Coating in simulated Seawater by D.E. Audette and P.A. Turley.

The leaching study satisfies the data requirements.

The general conclusions that can be drawn from this study are that leaching of zinc omadine in sea salt water reaches equilibrium after 21 days and is not likely to exceed 18 ug/cm^2/day. Based on leach rates at the 21-45 days, Hempel paint gave a leach rate of 18 and 15 ug/cm^2/day for radiolabeled and non labeled ZnOM, respectively. An E paint NO FOUL ZO with non labeled zinc omadine gave a leach rate of 7.2 ug/cm^2/day and a vinyl red navy paint gave a leach rate of 2.3 ug/cm^2/day. Cumulative leach amounts of 381, 287, 153 and 79 ug/cm^2 were obtained for the 1-14 day period for omadine in radiolabeled and non labeled zinc omadine in Hempel paint and for nonlabeled ZnOM in E paint NO FOUL ZO and Vinyl Red naval paint. A cumulative zinc release for the corresponding 1-14 day periods were not substantially different for paints with and without Zinc omadine.

The following data requirement remain unsatisfied and the data from the study will not be used until the issues and questions raised by the agency are resolved and the study is upgraded to acceptable.

The portion of the study dealing with seawater may be upgraded to acceptable with additional information to satisfy the anaerobic aquatic metabolism data requirements. The two replicates demonstrated high precision (reproducibility) but the results raise questions whether anaerobic conditions were fully maintained throughout the study period (see discussion section).

In addition to questions pertaining to the seawater/sediment portion, above, there are additional concerns with the fresh water portion of the study. Although replicates in the aerobic aquatic metabolism and the seawater portion of this study indicate high precision and reproducibility, the two replicates for the fresh water are too variable.