7-9-75

EEE BRANCH REVIEW

DATE: IN ____ OUT ____ IN 6/9/75 OUT 7/8/75 IN ____ OUT ____

FISH & WILDLIFE ENVIRONMENTAL CHEMISTRY EFFICACY

FILE OR REG. NO. 239-533

PETITION OR EXP. PERMIT NO. ____

DATE DIV. RECEIVED 4/23/75

DATE OF SUBMISSION ____

DATE SUBMISSION ACCEPTED ____

TYPE PRODUCT(S): I, D, H, F, N, R, S

PRODUCT MGR. NO. 21

PRODUCT NAME(S) Orthocide 50 Wettable

COMPANY NAME Chevron Chemical Company

SUBMISSION PURPOSE Registration on Taro in Hawaii only - resubmission

CHEMICAL & FORMULATION Captan (N-((trichloromethyl) thio)-4-cyclohexene - 1,2-dicarboximide)

1

1.0 CONCLUSIONS

1.1 We have not received fish accumulation data to aid in assessing hazards to the environment from the proposed use. However, since the use on taro in Hawaii is minor, we can waive the data requirement on fish accumulation for this use only.

1.2 We acknowledge that in lieu of a crab accumulation study the registrant will place a caution on the label such as "Do not use in areas where water is drained and/or discharged into adjacent marsh areas containing crabs that are harvested for food."

1.3 New uses of captan must be supported with a fish accumulation study on captan. We note that captan degrades to other metabolites than tetrahydrophthalimide (THPI) and that captan may be used at different rates than pesticides of similar structure. For example, a fish accumulation study on difolatan supporting its use on crops at 0.375 lb ai/A cannot be used to support captan used on crops at 50 lb ai/A—the application rates differing by a factor of 133.33X.

1.4 New uses of captan may also require other supporting data depending on the use proposed.

2.0 INTRODUCTION

2.1 Other names for captan are: Orthocide 406; SR-406; Vancide 89; N-trichloro-methylthio-3a, 4,7,7a-tetrahydrophthalimide; N-(trichloromethyl-mercapto)-Δ^4-tetrahydrophthalimide.

2.2 Properties:

d = 1.74
mp = 172-173 °C.

2.3 The product contains 50% active ingredient.

2.4 The proposed use is on taro in Hawaii only.

2.5 The reviews of this registration are:

239-533 (3/5/75)
239-533 (8/17/73) and addendum dated 8/27/73.

2.6 Other captan reviews:

3E1367 (10/4/73)

3.0 DIRECTIONS FOR USE

3.1 For use on wetland taro in Hawaii only.

3.2 Apply 50 lb ai/A in 500 gallons of water as a slurry to soil surface prior to planting. Till into a depth of 6 inches.

3.3 Apply 50 lb ai/A with a fertilizer as a homogeneous dry mix and broadcast on the dry soil before taro is planted and the field is flooded.

3.4 Apply only 1 preplant application.

3.5 Do not use if leaves are to be used as food or feed.

4.0 DISCUSSION OF DATA

4.3.4 ~~4.1~~ Hydrolysis studies

4.3.4.1 ~~4.1.1~~ Summary of Decomposition Studies on SR-406.

The hydrolysis of aqueous solutions of captan buffered at different pH's was monitored by determining the Cl- concentration by Volhard titration. The percent decomposition was calculated by dividing the found meq Cl-/aliquot by the theoretical meq Cl- based on 3 meq Cl- per mmole captan. (Since this method requires the loss of all 3 Cl ions from a captan molecule before it is considered as decomposed, the values of % decomposition are, therefore, only minimum values and may actually be much greater).

RESULTS

1. Captan, in aqueous solution at 0.03M, does not perceptively decompose at pH 3.6 after 8 hours. At pH 7.6 there is a minimum decomposition of 1.5 % after 25 hours. At pH 9.5 and after 21 hours, the minimum decomposition is 20.5 % and at pH 11.4 after 23.5 hours it is 71 %. The above results are for room temperature hydrolysis only.

2. Captan slurries of 0.03M, 0.055M and 0.69M were subjected to hydrolysis at pH 11.4. The results showed greater decomposition for the slurries of least concentration.

3. Captan decomposition in hot alkali - 1N NaOH at 100°C.

Molarity of captan slurry	Time (hrs.)	meq H^+ / mmole captan	meq Cl^- / mmole captan
0.097	1	5.1	2.6
0.113	4	5.7	2.8

4. Captan decomposes releasing 3 meq Cl^- per mmole of captan in boiling distilled water. The slurry concentration was 0.067M and total decomposition was reached in 2.33 hours. Decomposition at 80°C was about half of that at boiling in the same time. At 60°C and 20°C decomposition was less than 3%.

The presence of ~~iorn~~ iron in the distilled water decomposition apparatus produced no effect on the rate of decomposition.

5. The registrant points out in an article titled "Captan Toxicity to Fathead Minnows (Pimephales promelas), Bluegills (Lepomis macrochirus), and Brook Trout (Salvelinus fontinalis)" (copy submitted) that "the halflife of captan in Lake Superior water with a pH of 7.6 is about 7 hr. at 12°C and about 1 hr. at 25°C. Breakdown products from an initial 550 ug/liter of captan were not lethal to 3-month-old fathead minnows."

CONCLUSIONS

1. Captan decomposes in basic solution, with a greater rate of decomposition when the captan concentration is smaller. Captan also decomposes in boiling water. In basic solution and in boiling water the same amount of H^+ and Cl^- are released, however in 1N NaOH at 100°C twice as much H^+ is released than Cl^- indicating a different degradation mechanism in hot alkali than in room temperature alkaline solution or in boiling water. Therefore, captan is unstable in basic solutions and in hot aqueous solutions.

2. Half-lives of captan could not be determined in the various solutions because analysis was not for the parent but was for Cl^-.

3. Captan released minimal amounts of Cl ions when subjected to neutral and acid hydrolysis. This does not rule out another part of the molecule being degraded.

4.3.5 ~~4.1.2~~ Photodegradation

4.3.5.1 ~~4.1.2.1~~ UV degradation of captan

The registrant submitted a page copied from Residue Reviews, vol. 45, page 101, stating ultraviolet light (254 nm) causes complete degradation of captan or practically so; no products were identified.

4.3.6 ~~4.1.3~~ Degradation by microbes

4.3.6.1 ~~4.1.3.1~~ Microbial degradation

The registrant submitted a page copied from Residue Reviews, vol. 45, page 101, stating that captan splits at the N-S bond when reacting with fungal cells, releasing tetrahydrophthalimide and the trichlowmethyl group.

When captan is added to other cultures, thiophosgene and carbon disulfide are produced, however H_2S or carbon disulfide were not detected in captan treated soil.

Captan controls some fungi but encourages the growth of others.

4.3.8 ~~4.1.4~~ Other

4.3.8.1 ~~4.1.4.1~~ Chemical degradation of captan

The registrant submitted a page copied from Residue Reviews, vol. 45, page 100-101 describing chemical degradation of captan. Points made there are:

1. The rate of hydrolysis of captan increases with increasing temperature releasing HCl and H_2S.

2. There are conflicting reports concerning stability of captan at pH=7. One study shows it to be stable and one study shows it to degrade with a halflife of 2.5 hours.

3. Captan halflife in moist silt loam soil was 3-4 days and longer in air-dried soil.

4. Captan reacts in flasks with cysteine or glutathione yielding cystine, oxidized glutathione, thiophosgene, tehahydrophthalimide, H_2S, 2-thiazolidinethione-4-carboxylic acid and carbonyl sulfide.

5.0 SUMMARY

5.1 The registrant wishes to satisfy the captan fish accumulation study requirement with the difolatan fish accumulation study already reviewed. Stating that captan and difolatan rapidly hydrolyze at pH 7 primarily forming tetrahydrophthalimide (THPI), the registrant reasons that it is THPI and not the parent to which the fish are being exposed.

5.2 However, captan is to be applied in the field at a rate 133.33 times greater than difolatan, other captan metabolites besides THPI are formed in soil and hydrolysis data submitted (at pH 7-8) shows captan readily degrading in one case and persisting in another. Finally, the difolatan fish study killed all the fish eventhough accumulation was less than "1".

5.3 We note, however, the proposed use on taro in Hawaii is a minor one. Therefore, we will waive the captan fish accumulation study for this taro use only but require a label caution against using the product in areas where water is drained and/or discharged in adjacent marsh areas containing crabs. This label caution, in lieu of a crab accumulation study, is acceptable to the registrant.

5.4 The hydrolysis information submitted showed captan not releasing significant Cl ions when subjected to neutral and acid hydrolysis for about one day. However, the halflife of captan in Lake Superior (pH 7.6) at 12 and 25°C was 7 and 1 hour, respectively.

5.5 The registrant is not able to submit the data requested on certain studies (captan metabolites in microaerophillic two soil, hydrolysis at pH 3 and 5 and the wavelength used in the photodegradation study).

Ronald E. Ney, Jr. 7/3/75

Samuel M. Creeger 7/1/75
Environmental Chemistry Section - EEEB

6