

**Hydrogen Peroxide (35% PEROX-AID®) Clinical Field Trials -
INAD 11-669**

**Year 2011 Annual Summary Report on the Use of Hydrogen Peroxide
(35% PEROX-AID®) in Clinical Field Efficacy Trials**

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Summary

Hydrogen Peroxide (35% PEROX-AID®) has been used effectively in the U. S. under compassionate INAD Exemption #11-669 to control mortality in a variety of fish caused by ectoparasites. In calendar year 2011 (CY11), the efficacy of Hydrogen Peroxide (35% PEROX-AID®) (H₂O₂) was evaluated in 40 ectoparasite trials involving approximately 2.9 million fish to control mortality in Hawaiian kampachi and rainbow trout caused by ectoparasites. Trials were conducted at one state fish hatchery and one private fish hatchery. The compassionate study protocol under which treatments were administered allowed the investigator to use H₂O₂ on either three consecutive or alternate days for 0.5 - 1h at dosages ranging from 50 - 200 mg/L; or one day a week for 0.75 h at 400 mg/L. Overall, results of trials conducted in CY11 indicated that treatments appeared efficacious in 100% of the trials.

Introduction

The current labels for H₂O₂ use in aquaculture limits use to: 1) Freshwater-reared finfish eggs to control mortality due to saprolegniasis; 2) Freshwater-reared salmonids to control mortality due to bacterial gill disease; and 3) Freshwater-reared coolwater finfish and channel catfish to control mortality due to external columnaris disease. These label restrictions limit the overall utility of approved H₂O₂ use in aquaculture.

External parasites (ectoparasites) form one of the largest groups of pathogenic organisms of cultured aquatic species (Post 1987). Affected species include finfish (freshwater and marine) and invertebrates. Environmental conditions such as temperature change, poor water quality, and high organic loading due to intensive fertilization and feeding levels increase the incidence and spread of many external parasites. Stress (i.e., seining, handling, sorting, grading, vaccinating, anesthesia, crowding, and transport) is also a major contributor to most parasitic outbreaks in fish (Lasee 1995). Additionally, tissue damage induced by external parasites increases susceptibility to secondary bacterial and/or fungal infections (Lasee, 1995).

The organisms responsible for major parasitic infections on fish are, for the most part, protozoan and metazoan. The parasites affecting the external surface of fish typically include those of the genera *Ambiphrya*, *Chilodonella*, *Cleidodiscus*, *Dactylogyrus*, *Epistylis*, *Gyrodactylus*, *Ichthyobodo*, *Ichthyophthirius*, *Trichodina*, and *Trichophrya*. These parasites are highly opportunistic and have tremendous reproductive capabilities. Under normal conditions (e.g., in wildstock populations) these

organisms cause little pathology. However, under intensive culture where fish densities are typically high, many of these organisms can cause serious disease problems.

If parasitic infections are left untreated, they can cause substantial economic losses to commercial aquaculture, and severely impact the restoration, recovery, and preservation of depleted stocks of fish cultured by Federal and State agencies. The extent of losses of fish from parasites depends upon the severity of the primary cause of infection. Morbidity can vary from less than 10% to total loss of the population (Post 1987). Historically, immersion treatments (static and flush) using a variety of compounds have been used to control mortality caused by parasite infestations. A number of these compounds have been found, both experimentally and under production settings, to be relatively effective.

Purpose of Report

The purpose of this report is to summarize the results of CY11 supplemental H₂O₂ field efficacy data. We anticipate that CY11 data will be used to enhance the existing H₂O₂ database established from previous years, and will be considered in the “body of evidence” for the purpose of developing an appropriate label claim for the use of H₂O₂ in aquaculture.

Facilities, Materials, Treatment Procedures

1. Facilities

A total of 40 field efficacy trials were conducted at one state fish hatchery and one private fish hatchery. Treatments were used to control mortality caused by ectoparasites in two fish species. Water temperature during treatments at the various testing facilities ranged from 52.0 - 78.8 °F, with a mean treatment temperature of 76.1°F.

2. Chemical material

H₂O₂ (CAS No. 7722-84-1) is a clear colorless liquid that contains 35% hydrogen peroxide. All facilities used designated lots of H₂O₂ provided by Western Chemical, Inc, Ferndale, WA.

3. Treatment Methods

H₂O₂ treatments were administered in both freshwater and in saltwater sea cages.

H₂O₂ treatments that were administered in freshwater used either a flow-through or standing bath treatment method. Both procedures called for accurately weighed amounts of liquid chemical to be pre-mixed in an appropriate amount of non-chlorinated water. When using a flow-through system, the pre-mixed chemical was metered into rearing units at a rate to achieve the desired

treatment concentration during a 0.5 - 1 h period. When using a standing bath method, water flow to the rearing unit was turned off and the pre-mixed chemical added to the rearing unit and mixed thoroughly to ensure uniform H₂O₂ concentration throughout the tank. Thorough mixing was essential to ensure there were no H₂O₂ "hot spots." After the treatment, water flow was turned on again to flush the chemical out of the rearing unit.

Immersion treatments that were treated in saltwater entailed raising the sea cage to the equatorial rim and using a 12-pieced pie-shaped tarp clipped together at each abutment to contain therapeutant, water, and fish. Because the tarp is not one continuous piece and is porous, there is considerable dilution of therapeutant concentration that occurs throughout the treatment period. This situation is further exacerbated by direct exposure of the sea cages to ocean currents.

4. Drug dosages

During CY11, three H₂O₂ dosage treatment regimens were used. Listed below is the dose and the number of trials conducted:

1. 50 mg/L; 0.50 hr; 2 trials; freshwater
2. 100 mg/L; 0.50 hr; 2 trials; freshwater
3. 400 mg/L; 0.50 hr; 36 trials; saltwater sea cages

5. Number of treatments per disease outbreak

According to the Study Protocol, Investigators were allowed to administer H₂O₂ on (1) 1 - 3 consecutive/alternating days when used at a dosage of 50 - 200 mg/L; or (2) 1 time/wk at a dosage of 400 mg/L when used on marine fish species in sea cages.

Fish Species Treated and Fish Ectoparasites Involved in CY11 Trials

1. Species and size of fish treated

Two fish species, one marine non-salmonids and one salmonid, were treated during CY11. Treated fish ranged in length from 2.3 - 18.4 in; mean length was 11.8 in. Species treated included:

Marine non-salmonids

Hawaiian kampachi (*Seriola rivoliana*)

Salmonid

rainbow trout (*Oncorhynchus mykiss*)

2. Ectoparasite treated

Test fish were treated with H₂O₂ to control mortality caused by ectoparasites of the genera *Neobenedenia* and *Gyrodactylus*.

Data Collected

1. Pathologist's report

Fish health pathology reports provide essential information with respect to parasite confirmation and general fish health. No pathology reports were submitted with the CY11 trials.

2. Treatment response and drug accountability data

Drug receipt reports, drug use reports, diagnosis, treatment, and mortality reports (including adverse effects/toxicity observations), and fish disposition reports were prepared by study Investigators. Such reports were routed through the Study Monitor for review, and then sent to the AADAP Office for review, data analysis and report writing, entering data into a database, and archiving in permanent files.

As stated in the Study Protocol, mortality data was to be collected for at least five days prior to treatment, during treatment, and for at least 28 d post-treatment. Investigators were strongly encouraged to collect mortality data on a daily basis. However, for a variety of reasons, not all requested mortality data was collected. Reasons for an incomplete mortality record include: 1) splitting fish into additional rearing units to ease crowding and improve culture conditions, and 2) stocking fish shortly after final treatment.

Discussion of Study Results

- 1. General observations on the efficacy of H₂O₂ for the control of ectoparasites in treated fish** (Note: Table 1 provides a summary of all trials in which treatment appeared efficacious; Table 2 provides summary data for all trials; and Table 3 provides a brief description of all trials conducted during CY11 under INAD #11-669).

A. Efficacy at 50 - 100 mg/L H₂O₂

Rainbow trout were treated with 50 - 100 mg/L H₂O₂ for a 0.5 h duration for 3 consecutive or alternating days in four trials (Table 1). Investigators used H₂O₂ to control mortality caused by ectoparasites of the genera *Gyrodactylus*. H₂O₂ treatments appeared effective in all trials.

B. Efficacy at 400 mg/L H₂O₂

Hawaiian Kampachi were treated with 400 mg/L H₂O₂ for a 0.5 h duration for 1 day in 36 trials (Table 1). Investigators used H₂O₂ to control mortality caused by ectoparasites of the genera *Neobenedenia*. H₂O₂ treatments appeared effective in all trials.

2. Observed Toxicity

No toxicity or adverse effects relating to H₂O₂ treatment were reported in 38 trials. The investigator for two rainbow trout treatments conducted at 100 mg/L noted fish had an increase in swimming and jumping at 20 minutes into the treatments. Fish returned to normal behavior at 10 minutes post-treatment.

3. Observed Withdrawal Period

No withdrawal time is needed for fish treated with H₂O₂ under the current Food-Use Authorization dated June 23, 2010.

Current Study Protocol for Hydrogen Peroxide (35% PEROX-AID®) INAD #11-669

No changes have occurred to the current study protocol for Hydrogen Peroxide (35% PEROX-AID®) INAD #11-669.

Facility Sign-up List

Please see “Table 4. Facilities and Names of Investigators” for facilities that signed-up to participate in the Hydrogen Peroxide (35% PEROX-AID®) during CY11. Please note all of these facilities are in compliance with their reporting requirements to the NPDES authority.

Correspondence sent to Hydrogen Peroxide (35% PEROX-AID®) INAD #11-669

Participants

Please see the attached correspondence that was sent to all H₂O₂ participants after the AADAP Office received their sign-up form for CY11.

Number of Treated Fish under Treatment Use Authorization

Total number of fish treated during CY11 was 2,942,600. The total number of treated fish to count against the current treatment use authorization dated December 19, 2007 is 7,307,001.

Summary of Study Results

H₂O₂ was used at a dosage of 50 - 400 mg/L in 40 treatment trials in which fish were treated one to three times to control mortality. Hawaiian kampachi and rainbow trout were the only fish species treated and trials involved approximately 2.9 million fish. Treated fish ranged in size from 2.3 - 18.4 in. Water temperature during treatment ranged from 52.0 - 78.8°F, with a mean treatment temperature of 76.1°F. Overall, results showed that treatment appeared effective in 100% of the trials. There was no evidence of toxicity or adverse effects related to H₂O₂ treatment reported in 95% of the trials. Data from the CY11 trials indicate that the H₂O₂ treatment regimen recommended in INAD Protocol #11-669 is safe and effective to control mortality in fish caused by ectoparasites. As a result of the lack of quality criteria, such as dose verification, use of controls, replicates, and randomization, it is understood that these

data will be considered as ancillary data, and that pivotal efficacy studies are needed to definitively demonstrate H₂O₂ efficacy for the treatment of ectoparasites. However, the ancillary data described above should provide useful, corroborative data to help support a label claim for the use of H₂O₂ to control mortality associated with ectoparasites in a variety of fish species. Although it is anticipated that the majority of future efficacy data collected under INAD #11-669 will also be ancillary data, efforts will be directed towards the continued generation of high quality data.

References

- Lasee, B. A., editor. 1995. *Introduction to Fish Health Management*, 2nd edition. U.S. Fish and Wildlife Publication. Washington, D.C. 139 pp.
- Post, G.W. 1987. *Textbook of fish health*. Revised and expanded edition. TFH Publications, Inc., Ltd., Neptune City, New Jersey. 288 pp.

Table 1. Summary of Year 2011 H₂O₂ Efficacy Results - Efficacious Studies

Hatchery	Number of efficacious trials	Fish Species	Fish Size (in.)	Number of Fish	Ectoparasite	Dose (mg/L)	Duration (hrs)	Number of treatment days	Temp. (°F)
Boulder Rearing Station	2	RBT	2.3 - 6.0	57,700	Gyrodactylus	50	0.5	3	52.0
Boulder Rearing Station	2	RBT	4.5 - 9.0	42,500	Gyrodactylus	100	0.5	3	52.0
Keahole Point Fish LLC	36	KON	6.1 - 18.4	2,842,400	Neobenedenia	400	0.5	1	78.8

Table 2. Summary Data Regarding Year 2011 H₂O₂ Efficacy Studies

Total Number of Fish Treated:	2,942,600
Number of fish treated in efficacious trials	2,942,600
Total Number of Studies:	40
Efficacious trials	40
Treatment Regimens and Frequency Used:	
50 mg/L; 0.50 hr; 3 days	2 trials
100 mg/L; 0.50 hr; 3 days	2 trials
400 mg/L; 0.50 hr; 1 day	36 trials
Treatment Water Temperature (°F):	
Temperature Range	52.0 - 78.8
Mean Temperature	76.1
Size of Treated Fish (in.):	
Size Range	2.3 - 18.4
Mean Length	11.8
Species Treated:	
<u>Marine non-salmonids:</u>	
Hawaiian kampachi <i>Seriola rivoliana</i>	
<u>Salmonid</u>	
rainbow trout (<i>Oncorhynchus mykiss</i>)	
