UNIVERSITY OF FLORIDA
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VM-77

Use of Formalin to Control Fish Parasites[1]

Ruth Francis-Floyd[2]

INTRODUCTION - WHAT IS FORMALIN?

Formalin is a generic term which describes a solution of 37% formaldehyde gas dissolved in water. Solutions of formalin for use on fish should contain 10 to 15% methanol, which inhibits formation of paraformaldehyde (discussed below), a highly toxic compound. Two commercial products have been approved for use in aquaculture by the Food and Drug Administration (FDA). These are Formalin-F sold by Natchez Animal Supply, Natchez, Miss. and Paracide-F, sold by Argent Chemical Laboratories, Redmond, Wash. Both of these products have been approved by FDA for use on food fish (trout, salmon, catfish, largemouth bass and bluegill) as a parasiticide. There is no legal withdrawal time (time after the chemical was used before fish can be slaughtered for food) for either of these products.

HOW IS FORMALIN USED IN AQUACULTURE?

Formalin is used as a bath treatment to control external parasitic infections of fish. It is extremely effective against most protozoans, as well as some of the larger parasites such as monogenetic trematodes. Formalin effectively kills parasites on gills, skin, and fins. It is not the preferred treatment for external bacterial or fungal infections. In addition, high concentrations of formalin are used to control fungi on fish eggs. Formalin is not effective against internal infections of any type.

SPECIAL CONCERNS REGARDING THE USE OF FORMALIN

Concerns for safety of personnel

1) Formaldehyde is a known carcinogen. It should only be handled by personnel wearing protective clothing such as gloves.
2) Formaldehyde is a noxious gas. Formalin must be kept in a sealed container in a well-ventilated area. Exposure to fumes will result in irritation to eyes and respiratory surfaces.
3) Some people develop a sensitivity to formalin over a period of time which involves repeated handling of the chemical. These individuals should avoid handling the chemical.

Concerns for safety of fish

1) Formalin chemically removes oxygen from the aquatic environment. Each 5 mg/l of formalin applied removes 1 mg/l of dissolved oxygen. This is one reason why use of formalin in ponds is discouraged.
2) Formalin is an algicide. When applied to pond water, formalin kills a portion of the algae present, thereby reducing the ability of the algae to produce oxygen

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2. Ruth Francis-Floyd, Joint Associate Professor, Department of Large Animal Clinical Sciences and Department of Fisheries and Aquatic Sciences, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611.

through photosynthesis. Further decreases in oxygen in the pond can result as the dead algae decompose.

3) Formalin should be stored in an area where it is protected from extremes of heat and cold. Never use formalin when storage temperatures fall below 40°F (5°C) or when a white precipitate (powder) is present. At cold temperatures formaldehyde is transformed into paraformaldehyde (white precipitate), a highly toxic material which will kill fish on contact.
4) Formalin toxicity is increased at high water temperatures. If water temperatures exceed 70°F (21°C), the concentration used should be decreased.
5) When treating parasites on sensitive species, such as hybrid striped bass, the concentration of formalin delivered in a prolonged bath should not exceed 10 mg/l.

APPLICATION OF FORMALIN AS A PARASITICIDE FOR FISH

Formalin is applied as a bath treatment. It can be applied as a prolonged bath, which means it is placed into the water indefinitely, or it can be applied as a short-term bath, which means fish are placed into the bath for a relatively short period of time (30 to 60 minutes) and then placed into clean (untreated) water. The concentration of chemical used is determined by the period of time the fish are to be in contact with the chemical, the temperature of the water, and the condition of the fish. Extremely sick fish may not be able to tolerate a "full" treatment. Any time fish exhibit signs of distress (i.e., darting, gasping, or trying to jump out of the water) during a chemical treatment, they should be placed into clean (untreated) water at once.

The concentration of formalin appropriate for a prolonged bath is 15 to 25 mg/l. The lower concentration, 15 mg/l, would be appropriate for pond use, however, the use of formalin in ponds is discouraged for several reasons which are discussed below. The higher concentration, 25 mg/l, is easily applied to aquaria and tanks at 1 milliliter (ml) per 10 gallons, or 2 drops per gallon. These are quick and easy ways of measuring this concentration. Any time formalin is applied, vigorous aeration must be provided.

For short-term baths a concentration of 250 mg/l, or 1 ml per gallon, can be delivered for 30 to 60 minutes. At moderate water temperatures (less than 70°F or 21°C), fish can be left in a 250 mg/l formalin bath for about one hour; however, if fish are weak or noticeably sick, the treatment should be discontinued after 30 minutes. Never exceed one hour of chemical exposure at this concentration. If fish show signs of distress before the allotted time has elapsed, they should be removed from the treatment immediately. At warmer water temperatures (greater than 70^0F or 21^0C) the concentration of formalin should be decreased to 150 mg/l for no more than one hour. Vigorous aeration must be provided to fish during treatment.

If you are uncertain how to calculate the amount of formalin needed to treat your system, contact your IFAS county extension agent for assistance.

USE OF FORMALIN IN FISH PONDS

Although formalin has historically been used to control protozoan infestations of fish in ponds, its use in aquaculture ponds is generally discouraged. First, it is quite expensive, and large volumes are needed to treat even a small pond. Other, less expensive chemicals, such as potassium permanganate, are available which have the same spectrum of activity as formalin, but are more cost effective for commercial use. Second, formalin chemically removes dissolved oxygen from water, and this action, along with its algicidal activity, creates a situation which is conducive to development of an uncontrollable oxygen depletion. The direct cost and risk associated with use of formalin in fish ponds make its use in ponds difficult to justify.

USE OF FORMALIN IN HAULING BOXES

Any time fish are moved from one facility to another, there is concern about the potential spread of disease between populations. The potential spread of many protozoan diseases can be eliminated by treating fish for parasites while they are still in the hauling box. Ideally this should be done before they are transported, but if that is not possible, treatment of fish in the hauling box is a reasonable option.

To provide a formalin treatment to fish while they are still in the hauling box, water in the box must be tempered so that it is similar to receiving water in terms of temperature and pH before the treatment is started. When this is done properly, the treatment may be halted at any time by simply opening the box and releasing the fish into the pond. In addition, constant vigorous aeration must be available during the treatment. If these precautions have been taken care of, formalin can be applied as it would be for any short-term bath (150 to 250 mg/l based on water temperature for 30 minutes). Remember: never leave fish

unattended during treatment, and never leave fish in the formalin bath for more than 60 minutes.

USE OF FORMALIN IN HATCHERIES TO CONTROL FUNGUS ON EGGS

Formalin is approved by FDA for control of fungi in fish hatcheries. Concentrations of 1000 to 2000 mg/l can be applied to fish eggs for 15 minutes to aid in control of fungus. Hatchery managers are reminded that sanitation is important for the prevention of fungal invasions on fish eggs. Dead eggs should be removed from the system promptly because they serve as a source of infection for adjacent, healthy eggs.

SUMMARY

Formalin is a liquid formulation of 37% formaldehyde gas dissolved in water. Two brands of formalin, Formalin-F (Natchez Animal Supply, Natchez, Miss.) and Paracide-F (Argent Chemical Laboratories, Redmond, Wash.), have been approved by FDA as parasiticides for use on fish. Formalin is effective against many external parasites, including protozoans and monogenetic trematodes. It is not generally considered the best treatment for external fungal or bacterial infections. Formalin can be delivered in a short-term bath at a concentration of 250 mg/l - or 150 mg/l if water temperature is greater than 70°F (21°C) - for no more than 60 minutes. It can be delivered as an indefinite bath at a concentration of 15 to 25 mg/l. Formalin is an excellent parasiticide for use in tanks and aquaria, but its use in ponds is discouraged because it chemically removes oxygen from the water and can contribute to catastrophic oxygen depletion under pond conditions. This is avoided in tanks and aquaria by always supplying vigorous aeration when formalin is used. High concentrations of formalin (1000 to 2000 mg/l for 15 minutes) can be used to control fungal infections on fish eggs; however, appropriate management practices must be implemented to prevent recurrence.