ISU Fisheries Extension

Managing Iowa Fisheries

Use of Copper Compounds in Aquatic Systems

Copper has been used for many years as an effective algaecide in farm ponds and in aquaculture operations. But with its use only a thin line separates effective algae-treatment levels from lethal overdoses to fish. And not all fish are equally tolerant of copper sulfate: for example, the compound is highly toxic to salmonoids (trout and salmon). This fact sheet is designed to explain when and how to use copper in aquatic systems and which precautions to take before using it.

Copper can be used to control pond algae, including filamentous algae—Spirogyra spp., Pithophora spp., and Cladophora spp.—and higher algae—Chara spp. Copper comes in several readily water-soluble forms, the cheapest and most commonly used of which is copper sulfate (cupric sulfate pentahydrate). This form is available as either a crystal or a powder and is known as "bluestone" or "powder blue." When copper sulfate is bought from a commercial manufacturer of copper, the percentage of copper in the formula should be carefully noted. The following dosage rates assume 25 percent metallic copper.

Carefully note the percentage of copper in the formula. This package lists "copper expressed as metallic 25.0%."

Several companies market copper in chelated liquid and crystal forms. Chelated copper compounds stay in solution longer than copper sulfate does, tend to control algae better, and seem safer to fish. Chelated copper compounds do involve, however, higher initial costs than copper sulfate does. Dosage rates of copper compounds depend upon both manufacturer instructions and chemical type (liquid or granular).

Determination of Dosage Rates

Determine dosage rates before using any type of copper treatment. First, measure the total alkalinity, (not the hardness of your water), in parts per million (ppm), and the pH, since the toxicity of copper to fish increases as the total alkalinity and pH decrease. The following dosage rates for copper sulfate are listed by alkalinity level.

0-40 ppm	Do not use
40-60 ppm	0.33 ppm
60-90 ppm	0.5 ppm
90-200 ppm	1.0 ppm
Above 200 ppm	2.0 ppm

The maximum copper sulfate dosage rate is 2.0 ppm. One (1.0) ppm equivalencies are as follows.

- 0.0038 grams per gallon,
- 0.0283 grams per cubic foot,
- 0.0000624 pounds per cubic foot,
- 1.0 milligram per liter, and
- 2.7 pounds per acre-foot.

If total alkalinity is less than 40 ppm, copper treatments are not recommended. Algae control in waters with high alkalinity levels (greater than 250-300 ppm) can be improved by use of chelated copper compounds. Copper sulfate in waters with high total alkalinity levels will settle before algae is completely controlled. Alkalinity in Iowa waters is variable, so find out the concentration before treating with copper.

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Chemical Application

After determining and weighing the amount of copper sulfate needed to treat the volume of water, the compound should be thoroughly dissolved in the water. Copper sulfate is much heavier than water; if simply thrown into the pond as crystals or powder, it will sink to the bottom where pond muds will chemically bind with it and lock it up. Copper sulfate should be as diluted as possible and great care should be taken in its distribution, so as to avoid the creation of "hot spots," or areas with high copper concentrations. Compounds also can be placed in a porous burlap bag and pulled behind a boat so that they gradually dissolve.

When using a commercially formulated copper, such as any of the chelated compounds, follow the label instructions for dosage rates. Liquid forms can be applied directly to the water, but they should first be mixed with the water in order to be dilute. As with copper sulfate, great care should be taken to disperse commercial formulations evenly over the entire pond area, thereby avoiding the creation of hot spots.

Precautions

Copper compounds are extremely corrosive to steel containers; be sure to rinse steel containers well after using them to store this chemical. Contact with skin and eyes may be irritating. Be wary, too, of treating ponds from which sheep drink: sheep have a low tolerance of copper components, and overexposure may be fatal. Copper is also toxic to Koi.

In a pond with algae, copper treatments may cause oxygen concentrations to drop, resulting in fish kills. Pond algae are a major source of oxygen; when algae are removed, the source of oxygen also is removed. Additionally, oxygen will be consumed as the algae decompose. When treating a pond with copper, either treat in a series of small doses over time or have emergency aeration available. One method is to treat one fourth to one third of the area at a time, wait 10 to 14 days, treat again, and repeat until desired dosage rates are obtained. A degree of algae control should be evident within the first week after the initial application.

Copper also is toxic to most pond zooplankton (for example, daphnia and rotifers). If you are relying on the zooplankton as a food source, e.g., in fish fry culture ponds, you may not want to use copper, which does not break down in the environment but forms

Granular copper should be thoroughly dissolved in water. If not, it will simply sink to the bottom of the pond and be chemically bound by the soil.

insoluble compounds with other elements. Although copper rapidly disappears from water after application as an algaecide, it can accumulate in bottom sediment after repeated high rates of application.

As long as water pipes are not galvanized, copper can be used in backyard pools containing ornamental fish. But the combination of copper and galvanized pipes can yield chemical compounds fatal to the fish. Keep in mind that limited information exists regarding effects of copper on different ornamental fish; use caution when first using copper compounds. Moreover, you still need an accurate measure of total alkalinity and pH before safe treatment can be assured.

Algae problems in your pond are ultimately controlled by you addressing the causes and not just the symptoms. The influx of watershed nutrients needs to be regulated if satisfactory control of algae is to be achieved in the long term.

In conclusion, copper treatments are quite effective algaecides in certain situations and are inexpensive compared with other treatments. Yet caution must be exercised as a result of the effects of such treatments on fish and other aquatic life. If your water is low in alkalinity or pH, or if you have heavy algae bloom and no aeration, copper treatments are not recommended. Finally, as with any chemical application, you as the end user are responsible for reading and following all labeled instructions.

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