Auburn University and USDA/Natural Resources Conservation Service

Alabama Aquaculture Best Management Practice (BMP)

Water Quality Enhancers

BMP No. 12

Definition

A number of chemicals are used in pond aquaculture to enhance pond water quality. The compounds used most commonly in Alabama catfish ponds are calcium oxide or hydroxide (lime), sodium chloride (salt), copper sulfate, calcium sulfate (gypsum), aluminum sulfate (alum), and calcium hypochlorite. Water normally is not discharged from catfish ponds for several weeks after these compounds are applied, and their concentrations in effluents would not normally be high enough to cause adverse effects in receiving waters. Because improper use of these compounds could possibly impair effluent quality, guidelines for their use are needed.

Explanation

Agricultural limestone often is applied to acidic waters to increase total alkalinity. Harmful effects resulting from applications of agricultural limestone to aquaculture ponds have not been reported. Agricultural limestone is not used often in Alabama catfish farming because few catfish farms are located in areas with acidic, low alkalinity waters.

Hydrated lime often is applied to ponds in small doses for reducing phytoplankton growth or to remove carbon dioxide. The main effect of lime application is to increase pond water pH. Hydrated lime doses of 200 lb/acre or more may increase water pH above 10. Applications usually are less than 100 lb/acre, because high pH following large lime applications could be harmful to fish. Nevertheless, lime application may cause pH in pond surface water to increase to 9.0 to 9.5. The pH will decline within 1 or 2 days as the hydroxide from lime reacts with carbon dioxide. Lime applications normally are made in summer when ponds are not discharging water. Thus, there is little danger of high pH in catfish pond effluents as a result of liming.

Sodium chloride applications are made to increase chloride concentrations and counteract nitrite toxicity. Fish in waters containing 10 to 20 times more chloride than nitrite will not be harmed by high nitrite concentration, for chloride interferes with nitrite absorption across the gill. Sodium chloride applications usually are between 50 and 100 ppm, and such small doses will not increase chloride concentration or salinity enough to harm freshwater aquatic organisms. Effluents from salt-treated ponds do not represent an ecological threat.

Copper sulfate usually is applied at 0.25 to 1.0 ppm for phytoplankton control. Copper sulfate precipitates from water within a few hours (Figure 1), and problems with high copper concentrations in effluents have not been reported. Copper sulfate should not be added to ponds that are discharging water.

Calcium sulfate may be added at rates of 500 to 2,000 lb/acre to increase calcium hardness in waters and to precipitate suspended clay particles and reduce turbidity. No adverse effects of effluents from calcium sulfate-treated ponds have been reported. Also, this compound seldom is applied to channel catfish ponds. Aluminum sulfate sometimes is applied to ponds at concentrations of 25-50 ppm to remove turbidity from suspended soil particles. Aluminum sulfate is acidic, but if the alkalinity of pond water is equal in parts per million to the aluminum sulfate-treatment rate, the pH will not decline appreciably and aluminum will rapidly precipitate. No environmental hazards should result where effluents from alum-treated ponds enter natural waters.

Calcium hypochlorite is sometimes applied to catfish ponds at 0.05 to 0.1 ppm with the intent of controlling bacteria and phytoplankton abundance. Research has

shown that this treatment is ineffective, and chlorination of pond waters is not recommended.

Use of amendments

Practices

- *Store amendments under a roof where rainfall will not wash them into surface waters.*
- *Copper sulfate applications in parts per million should not exceed one-one hundredth (0.01) of total alkalinity also measured in parts per million. Pond water should not be released for 72 hours after application of copper sulfate.*
- *Sodium chloride use should not exceed 200 ppm per application.*
- *Lime (calcium oxide or hydroxide) use should not exceed 100 lb/acre per application.*
- *Agricultural limestone and gypsum (calcium sulfate) use should not exceed 5,000 lb/acre per application and 2,000 lb/acre per application, respectively.*
- *Calcium hypochlorite or other chlorine compounds should not be applied to catfish ponds.*
- *Only use water quality enhancers that have been approved by the Food and Drug Administration and the Environmental Protection Agency and carefully follow instructions on labels.*
- *When rotenone is used in ponds, do not discharge water until the rotenone has detoxified naturally. Rotenone will detoxify in 1 week at water temperatures of 20^{o}C and above, and in two weeks at lower temperatures.*

Implementation notes

Dose rates for water quality enhancers depend upon pond volume. Accurate estimates of pond volume upon which to calculate the amounts of water quality enhancers needed to provide target concentrations are important. If the pond volume is overestimated, the concentration of the water quality enhancer also will be overestimated. An excessive dose could harm fish and result in a harmful concentration of a substance in effluent.

Water samples from ponds can be analyzed for concentrations of chloride, chlorine, copper, and other water quality enhancers. These analyses should be made when there are questions about the influence of the substances on fish or their concentrations in effluents.

References

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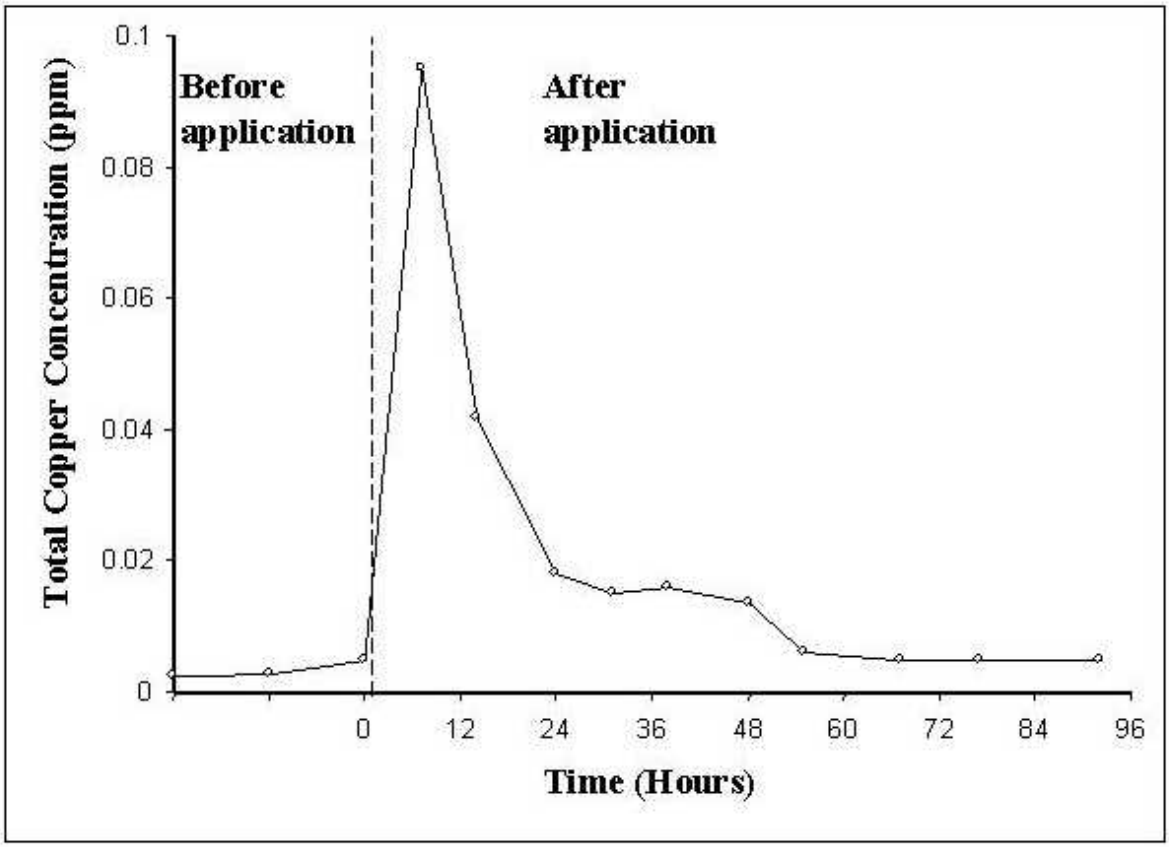

Figure 1. Average total copper concentrations in three earthen ponds. (All ponds were treated at 12 lbs. copper sulfate/acre to achieve a concentration of 0.3 ppm copper.)