

Copper Compounds as Algaecides

I n s p i r e d B y N a t u r e

Copper sulfate and other derivatives of copper have been used to control undesirable algae in lakes and ponds. Application consists of spreading copper sulfate crystals or powder along problematic areas, or spraying a slurry across the water surface. In most instances, copper sulfate is very effective in killing the floating mats of algae; unfortunately, such control of algae is of very short duration. On the contrary, the negative impacts of the copper sulfate are long term.

Following application of the copper salt, reactive copper concentrations become elevated and remain so for about two hours. The active copper ions are attracted to carbonate ions and become strongly bound. This new compound of copper carbonate drops out of the water column and binds up the copper. The result is that the copper is only effective at killing algae for only two hours. Button et al. (1977) performed copper experiments in Columbus, Ohio ponds, demonstrating that within two hours, the copper concentrations returned to pretreatment levels. After this period, only the algae exposed to the copper for the 2 hour time period may die. However, new algae already begin to grow following the precipitation of the copper. To add to this, the alga that has been killed is releasing nutrients, spurring new growth.

Besides promoting algae growth as a result of nutrient recycling, copper sulfate kills tiny beneficial animals that filter algae from the water column. Doses of copper sulfate required to kill algae are 10 to 100 times that required to kill these beneficial zooplankton (Cooke and Kennedy 2001). The result is increased planktonic algae growth with every copper sulfate application. Cooke and Kennedy affirm this reporting that "very low levels of copper are toxic to algae-grazing zooplankton, leading to a 'rebound' of algal biomass as copper is removed from the water column by precipitation within hours of application."

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For drinking water ponds, there is also concern of the copper-induced release of toxins from blue-green algae. Specific types of algae produce toxins harmful to humans and pets. These toxins can cause gastrointestinal distress, liver failure, and even death (Hitzfeld et al. 2000). Bluegreen algae blooms are more prevalent in ponds without algae-grazing zooplankton, a situation that can result from copper treatments (Cooke and Kennedy 2001). Copper sulfate has also caused species of bluegreen algae cells to lyse, causing the release of hepatotoxins into the water column (Lam et al. 1995). Because typical water treatment methods have limited ability to remove these toxins, preventing the growth of these algae is key.

Finally, copper sulfate negatively affects the benthic community in lakes and ponds. The rapid precipitation of the copper ions causes the accumulation of the copper in the bottom sediments. At this point, the copper reduces the diversity of benthic organisms that maintain the aquatic ecosystem. Most importantly, benthic microbe (bacteria) growth is inhibited by elevated copper concentrations. Without microbes, dead organic material accumulates on the pond bottom, causing a rapid filling of the pond. Without the use of copper, microbes will thrive on the dead organic material and will slow the filling process of the pond.

Copper sulfate has historically provided a quick fix for algae problems in lakes and ponds. Unfortunately, the long-term side-effects outweigh the short-lived benefits. While attempting to make ponds more aesthetically pleasing, the balance of the ecosystem is skewed, pond filling accelerates, and the possibility of algae toxicity increases. The best solution for excessive algae is to eliminate copper usage and to adopt a Holistic Approach. This approach includes aeration, microbial augmentation, and physical removal.

References

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