

# COPTROL VS COPPER SULPHATE FOR THE TREATMENT OF ALGAE

## Literature Review

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Prepared for Aquatic Technologies

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# COPTROL VS COPPER SULPHATE FOR THE TREATMENT OF ALGAE

## OVERVIEW

- ✍ This literature review compares the use of Copper Sulphate with the use of Coptrol to treat algae
- ✍ Copper compounds like copper sulphate are commonly used in the treatment of algae, but these often contain large amounts of harmful copper ions, making them unsafe for use in water intended for drinking, livestock watering and irrigation
- ✍ Coptrol consists of copper in a non-ionic chelated form that is completely safe to use around aquatic organisms like fish and crustaceans, and for use in irrigation and drinking water
- ✍ Coptrol can be used in all types of water, unlike copper sulphate
- ✍ Coptrol is highly effective, meaning less is required to treat the same amount of algae compared to copper sulphate, making it very cost-effective

## INTRODUCTION

Blooms of algae are becoming more common in a wide range of aquatic ecosystems, particularly those found near residential, agricultural and recreational sites.<sup>1,2</sup> Algae blooms are associated with runoff from urban, suburban and agricultural lands that reach waterbodies like lakes, ponds and streams.<sup>3</sup> This runoff is often high in nitrogen and phosphorous, chemicals that algae thrive in.<sup>4</sup> Once an algae bloom is established in a waterbody, it severely impacts the quality of all water contained within, and poses a continuous danger to aquatic wildlife that occupies the waterbody.<sup>5,6,7</sup> In addition, the tainted water poses a severe health risk to any humans or livestock that consume or come into contact with the water.<sup>8,9</sup>

Copper in the form of copper sulphate has commonly been used as an algaecide since the early 1900s.<sup>10,11</sup> While copper has a toxic effect on most algae species, there are many inherent disadvantages associated with using copper in its copper sulphate form. Some of these include high dosages<sup>12,13,14</sup> and many associated health hazards.<sup>15</sup> Therefore, a better designed and modern approach of copper algaecide treatment in the form of Coptrol is recommended. Unlike copper sulphate, Coptrol requires a smaller application rate to achieve the same results, and is therefore a much safer alternative all round.<sup>16</sup>

## IMPACTS OF ALGAL BLOOMS IN WATER

### Environmental

- Cyanobacteria blooms form dense mats that prevent light and oxygen from entering the water<sup>17</sup>
- Cyanobacteria blooms release toxic compounds that alter water quality and reduce beneficial bacteria necessary for local water dynamics<sup>17</sup>
- Toxins released by Cyanobacteria blooms endanger the lives of local wildlife and reduce overall biodiversity<sup>18,19</sup>

<b>Economic</b>	<ul style="list-style-type: none"> <li>Algal mats block irrigation equipment (intakes, filters, pipes &amp; pumps), reducing pumping efficiency and increasing pumping time and cost<sup>20</sup></li> <li>Mats of algae obstruct commercial fishing nets resulting in reduced fish production<sup>21</sup></li> <li>Cyanobacterial toxins prevent the usability of water for drinking, irrigation, livestock watering, etc.<sup>18,21</sup></li> </ul>
<b>Social</b>	<ul style="list-style-type: none"> <li>Cyanobacteria blooms release toxic compounds that cause serious illness in humans and domestic pets<sup>17,18</sup></li> <li>Algal blooms contaminate water with unpleasant tastes and odours<sup>17</sup></li> <li>Algal blooms alters the colour of open water bodies, reducing their natural beauty<sup>17,21</sup></li> <li>Dense algal mats prevent recreational activities like swimming and fishing<sup>21</sup></li> </ul>

## COPPER SULPHATE ALGAECIDES

- ✍ Copper sulphate has been used as an algaecide for decades; most algaecides are copper-based<sup>10,11</sup>
- ✍ In water, copper sulphate dissociates into copper ions and sulphate ions, greatly increasing the level of ionic copper available for uptake by non-target organisms<sup>16</sup>
- ✍ Ionic copper is quite toxic to many aquatic species, including most fish, crustaceans and other invertebrates,<sup>15,16</sup> and even large waterfowl like geese<sup>22,23</sup>
- ✍ Excess copper ions in drinking water cause many gastrointestinal diseases in both humans and livestock if consumed repeatedly<sup>24,25,26,27</sup>
- ✍ The tendency of un-chelated copper ions to bind to soil means that irrigation water treated with copper sulphate algaecides leads to the build-up of copper in soils at levels that can damage crops<sup>28</sup>
- ✍ Copper sulphate easily forms precipitates in hard water<sup>12</sup> or water that contains dissolved organic matter from soil runoff.<sup>13</sup> This means that less copper is available for uptake by algae, thus reducing its toxicity to algae
- ✍ The algae themselves release complex particles (ligands) that attach to dissolved copper ions, reducing the efficacy of copper sulphate-based algaecides<sup>14,29</sup>
- ✍ To overcome precipitation and neutralisation, large dosages of copper sulphate are required to remain effective as an algaecide<sup>16</sup>

## COPTROL

- ✍ Coptrol is a chelated form of copper using organic agents, making it structurally different from copper sulphate<sup>16</sup>
- ✍ Coptrol does not form precipitates in hard water or water with dissolved organic matter, and is not neutralised by algae<sup>15,30</sup>
- ✍ Coptrol contains less elemental copper than copper sulphate, and all copper is present in a non-ionic chelated form, making it safer for non-target organisms<sup>16</sup>. Additionally, the dose of Coptrol needed for

successful treatment is significantly small. This makes it ideal for use in water intended for drinking, livestock or irrigation<sup>31</sup>

- ✍ Coptrol targets algae more effectively by readily passing through algal cell walls and membranes<sup>16</sup>
- ✍ Coptrol persists in water, thus maintaining its algitoxic ability for a long time<sup>32</sup>
- ✍ Due to Coptrol's high efficacy and long-term effects compared to copper sulphate, less Coptrol is required to achieve the same results as copper sulphate,<sup>16</sup> making it very cost-effective
- ✍ After being absorbed by algae, Coptrol's ultimate fate is as insoluble copper carbonate that is harmless to aquatic organisms, humans, livestock and crops<sup>33</sup>

## BENEFITS OF COPTROL OVER COPPER SULPHATE ALGAECIDES

**Table 1.** Comparison of the benefits of using Coptrol instead of copper sulphate-based algaecides.

Copper Sulphate Algaecide	Coptrol
<ul style="list-style-type: none"> <li>▪ Precipitates rapidly in hard water or muddy water, reducing its efficacy<sup>12,13</sup></li> <li>▪ Is easily neutralised by particles produced by algae<sup>14,29</sup></li> <li>▪ Does not last long in water<sup>13</sup></li> <li>▪ Large dosage is needed to remain effective as an algaecide<sup>16</sup></li> <li>▪ Greatly raises the amount of copper ions in water, which are toxic for waterfowl<sup>22,23</sup> and aquatic organisms including fish, crustaceans and invertebrates<sup>15,16</sup></li> <li>▪ Not suitable for use in drinking water as the consumption of excess copper ions causes gastrointestinal diseases in humans and livestock<sup>24,25,26,27</sup></li> <li>▪ Not suitable for use in irrigation water as the unchelated copper ions build up in soil and damage crops<sup>28</sup></li> </ul>	<ul style="list-style-type: none"> <li>▪ Does not form precipitates in any type of water<sup>15,30</sup></li> <li>▪ Is not affected by algal neutralising particles<sup>30</sup></li> <li>▪ Lasts longer in water, maintaining its algitoxicity for a longer period of time<sup>32</sup></li> <li>▪ Smaller dosage is required to treat the same amount of algae as other algaecides since it is absorbed easily by algae cells<sup>16</sup></li> <li>▪ Is safe for use with waterfowl, fish and other aquatic organisms since its active copper constituent is in a non-ionic chelated form<sup>16</sup></li> <li>▪ Is ideal for use in drinking water since its active copper constituent is in a chelated form and causes no harm when consumed<sup>16,31</sup></li> <li>▪ End products of treatment are chemically inert and pose no danger when present in irrigation water<sup>33</sup></li> </ul>

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