

MANAGEMENT OF ALGAE USING ALGAE MASTER

Literature Review

By Dilini Eriyagama

Monash University

Bachelor of Chemical Engineering (Honours) and Bachelor of Actuarial Science

Prepared for Aquatic Technologies

© Aquatic Technologies – February 2021

MANAGEMENT OF ALGAE USING ALGAE MASTER

OVERVIEW

- The effect of Algae Master's active ingredients on algae was explored by examining current literature.
- Algae Master is a multipurpose liquid suspension that can be used to manage algae growth and suspended particles in water bodies
- Algae Master has three mechanisms of action. It controls algae growth by coating the algae and sinking it. It reduces the phosphorus content in the water body. It acts as a flocculating agent which reduces the amount of suspended particles in the water.
- There are added benefits to using Algae Master including lowered pH and turbidity levels, improved water quality and increased fish growth and survival rates
- The use of Algae Master's active agents is recommended by multiple government agencies in Australia.

INTRODUCTION

Algae are primitive plants that do not have proper roots, stems or leaves [1]. Algae can be categorised as microalgae (microscopic), mat forming filamentous (threadlike) algae, or larger plant-like algae [1]. An algal bloom occurs when algae accumulate to a point where they discolour the water [2]. Algae are vital photosynthetic organisms. However, some algal blooms (such as blue-green algae) are harmful [3]. They can clog pipes, produce unpleasant tastes and odours, limit recreational activities, affect fish populations and reduce the water quality [2, 3]. Decaying algae reduces oxygen content in water and can cause death of fish and other aquatic organisms [4]. Blue-green algae, specifically, can produce toxins that can cause health problems in humans, domestic animals and livestock [5, 6]. Therefore, the control of algae in water bodies is an important consideration [7]. Algae Master is a concentrated liquid suspension which targets algae and acts as a water flocculent. The use of Algae Master has shown to be an effective algae management strategy.

HOW IT WORKS

The growth of algae is favoured in water bodies with high concentrations of nitrogen, phosphorus and other plant nutrients [1]. Phosphorus is the most important nutrient for blue-green algae [8]. Furthermore, turbid (cloudy/muddy) water can promote undesirable growth of algae [9]. Algae Master has three modes of action:

- | | |
|----------------------------|--|
| Algae agitate | <ul style="list-style-type: none">• Algae Master coats the algae and lumps them together. The active ingredients in Algae Master makes the algae lumps heavy causing it to rapidly sink to the bottom of the water body [10]. The algae is starved of nutrients leading to its subsequent death.• When algae die, it is decomposed by bacteria releasing more nutrients into the water which catalyses further algae growth. The sinking and coating action of Algae Master prevents the algae from breaking down and preventing release of nutrients important for further algae growth [10] |
| Phosphate stripping | <ul style="list-style-type: none">• The active ingredients in Algae Master bond to the phosphorus in sediment and the water mass [11] [12]• The reduction in phosphorus levels is necessary in inhibiting algae growth [12] |
| Flocculating | <ul style="list-style-type: none">• Algae Master flocculates suspended clay and other solid particles causing them to coagulate and precipitate [13]• Reducing turbidity is important to ensure the water body is healthy. High turbidity levels reduce the amount of light that gets through, increases the water temperature which reduces the amount of dissolved oxygen. Sufficient light and dissolved oxygen in the water is essential for survival of aquatic organisms [9] |

BENEFITS OF USING ALGAE MASTER

- ✓ Multipurpose
- ✓ Impairs algae growth [8, 12, 14]
- ✓ Reduces turbidity of water through flocculating action [13, 15]
- ✓ Removes excess phosphorus [8, 12, 14]
- ✓ Non-toxic – aquatic organisms not affected by product [12, 15]
- ✓ Increased fish biomass [12]
- ✓ Prevents accumulation of phosphorus [11]
- ✓ Long lasting [10, 15]
- ✓ Fast-acting [8]

USE IN AUSTRALIA

- The New South Wales (NSW) Department of Primary Industries (DPI) states the active ingredients in Algae Master can be used to protect small water bodies against blue-green algae [14]
- An information sheet prepared by the Environmental Protection Authority (EPA), Department of Environment and Water, and Primary Industries and Regions South Australia recommends the active agents in Algae Master to limit the growth of harmful algae [16]
- The Northern Territory Department of Primary Industries and Resources declares that the active compounds in Algae Master have proven to be an effective means of removing nutrients required for harmful algae growth [8]
- Agriculture Victoria suggest the use of the active components in Algae Master to manage harmful algae growth [17]

EFFECTS ON WATER QUALITY

| | |
|--------------------------|--|
| Phosphorus levels | <ul style="list-style-type: none">• Too much phosphorus in water is considered a pollutant as it can result in excessive algal blooms and the subsequent decomposition and depletion of dissolved oxygen [18]• The total phosphate concentration is significantly lower in water bodies treated with the active ingredients in Algae Master [12, 19]• The reduction in phosphorus levels reduce the abundance of algae in water bodies treated with Algae Master [20]• The active agents in Algae Master prevent the release of phosphorus from the sediment into the water column [12] |
| Turbidity | <ul style="list-style-type: none">• Water turbidity is a measure of soil particles, uneaten feed and any other materials suspended in the water column [21].• Turbid waters can increase algae growth [9] and is troublesome to fish (Lawson 1995)• Studies have shown that the active ingredients in Algae Master reduced the turbidity of water by approximately 50 – 70% [12]• The decrease in turbidity is attributed to the bonding effect of the product on soil particles preventing it to resuspend again to the water column and the reduction in phytoplankton abundance in the treated ponds than control [22] |
| pH | <ul style="list-style-type: none">• pH is an important factor that affects the life of aquatic organisms, solubility and toxicity of chemicals and heavy metals in water [21]• Water bodies treated with Algae Master have pH values lowered by 0.5- 1 units [12]• This reduction in pH is explained by lower phosphorus levels and reduced photosynthetic activity [23, 24] |
| Nitrogen content | <ul style="list-style-type: none">• Decreased nitrogen concentration due to lower concentration of algae in water bodies treated with Algae Master [12]• This is due to the fact that algae has the ability to fix atmospheric oxygen [23] |

EFFECT ON FISH LEVELS

- Studies have shown that ponds treated with the active components in Algae Master provide suitable conditions for fish growth and exhibit high fish survival rates (98-99%) [12]
- This is ascribed to improved turbidity, lowered pH levels, increased abundance of fish nutrients and favourable water quality parameters in water bodies treated with Algae Master's active compounds [12]

SAFETY

- The active ingredients in Algae Master is used as standard practice in conventional water treatment processes around the world [13]
- Algae Master and its constituents, when applied according to recommended dosage, provide a safe and effective management strategy for the control of algae [8, 13, 16, 17, 25]

MANAGEMENT PERIOD

- For best results, it is recommended that water bodies be dosed as soon as algae growth is identified, prior to the formation of a bloom [8]

REFERENCES

- [1] B. S. Chauhan and G. Mahajan, *Recent Advances in Weed Management*, 1st ed. 2014. ed. New York, NY : Springer New York : Imprint: Springer, 2014.
- [2] E. Granéli and J. T. Turner, *Ecology of Harmful Algae*. Springer, 2007.
- [3] S. E. Shumway, J. A. M. Burkholder, and S. L. Morton, *Harmful Algal Blooms: A Compendium Desk Reference*. Wiley, 2018.
- [4] T. S. Lee, *Research and Practices in Water Quality*. IntechOpen, 2015.
- [5] Agriculture Victoria. (2020). *Managing blue-green algae in farm water supplies* Available: <https://agriculture.vic.gov.au/farm-management/water/blue-green-algae-in-water/managing-bluegreen-algae-in-farm-water-supplies>
- [6] Western Australia Government. (2020). *Managing blue-green algae on farms in Western Australia*. Available: <https://www.agric.wa.gov.au/livestock-biosecurity/managing-blue-green-algae-farms-western-australia>
- [7] S. A. Nichols, *Mechanical and Habitat Manipulation for Aquatic Plant Management: A Review of Techniques*. Department of Natural Resources, 1974.
- [8] (2017). *Barkley Beef - Toxic Algal Blooms*. Available: https://dpiir.nt.gov.au/_data/assets/word_doc/0003/407469/BB_March_2017.docx
- [9] T. L. Provin and J. L. Pitt. (2013). *Water Management: Clearing Cloudy and Muddy Water in Ponds and Lakes*. Available: <http://publications.tamu.edu/WATER/SCS-2013-02.pdf>
- [10] J. Wollenburg, C. Katlein, I. Peeken, and F. Mehrtens, "The gypsum gravity chute: A phytoplankton-elevator to the ocean floor."
- [11] V.-P. Salonen and E. Varjo, "Gypsum treatment as a restoration method for sediments of eutrophied lakes—experiments from southern Finland," *Environmental geology*, vol. 39, no. 3-4, pp. 353-359, 2000.
- [12] N. A. Ibrahim, "Effect of gypsum treatment on water quality parameters and fish performance in fertilized polyculture earthen ponds," 2012.
- [13] J. Bratby, *Coagulation and Flocculation in Water and Wastewater Treatment*. IWA Publishing, 2006.

- [14] (2017). *Farm water quality and treatment: Algae*. Available: <https://www.dpi.nsw.gov.au/agriculture/water/quality/pubs-and-info/blue-green-algae/farm-water-quality-and-treatment-algae>
- [15] B. Huser, P. Brezonik, and R. Newman, "Effects of alum treatment on water quality and sediment in the Minneapolis Chain of Lakes, Minnesota, USA," *Lake and Reservoir Management*, vol. 27, no. 3, pp. 220-228, 2011.
- [16] Environmental Protection Authority (EPA), Department for Environment and Water, and Primary Industries and Regions SA, "Post-bushfire water quality in farm dams and creeks," ed, 2020.
- [17] Agriculture Victoria. (2021). *Minimising algal growth in farm dams*. Available: <https://agriculture.vic.gov.au/farm-management/water/managing-dams/minimising-algal-growth-in-farm-dams#:~:text=minimise%20nutrient%20level%20of%20water,sunlight%20load%20on%20the%20dam>
- [18] A. Bratt, J. Finlay, J. Welter, B. Vculek, and R. Van Allen, "Co-limitation by N and P Characterizes Phytoplankton Communities Across Nutrient Availability and Land Use," *Ecosystems*, vol. 23, no. 6, pp. 1121-1137, 2020.
- [19] E. Varjo, A. Liikanen, V.-P. Salonen, and P. J. Martikainen, "A new gypsum-based technique to reduce methane and phosphorus release from sediments of eutrophied lakes::(Gypsum treatment to reduce internal loading)," *Water Research*, vol. 37, no. 1, pp. 1-10, 2003.
- [20] C. E. Boyd, "Water quality in ponds for aquaculture," 1990.
- [21] C. E. Boyd and C. S. Tucker, *Pond Aquaculture Water Quality Management*. Springer US, 2012.
- [22] M. S. Islam, M. J. Sarker, T. Yamamoto, M. A. Wahab, and M. Tanaka, "Water and sediment quality, partial mass budget and effluent N loading in coastal brackishwater shrimp farms in Bangladesh," *Marine pollution bulletin*, vol. 48, no. 5-6, pp. 471-485, 2004.
- [23] N. Ibrahim, "Effect of Phytoplankton (*Chlorella vulgaris* and *Scenedesmus* spp.) Inoculation on Water Quality for Tilapia Culture by Urea and Superphosphate," Ph. D. Dissertation, Animal production dept., Fac. of Agri. Cairo Univ, 2001.
- [24] G. O. El Naggar, N. A. Ibrahim, and M. Y. Abou Zead, "Influence of fertilizers' types and stocking density on water quality and growth performance on Nile tilapia African catfish in polyculture system," 2008.
- [25] G. J. Burtle, "Managing Fish Ponds During a Drought," ed: The University of Georgia College of Agricultural and Environmental Sciences & U.S. Department of Agriculture,, 2007.