THE USE OF COPTROL WITH AQ200 FOR SUBMERGED AQUATIC WEED CONTROL

Literature Review

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OVERVIEW

- Literature discussing the effect of using Coptrol in combination with AQ200 for aquatic weed and algae management was evaluated.
- Multiple studies show that the Coptrol-AQ200 combination increases the efficacy of weed and algae control compared to the activity of each product alone.
- The use of Coptrol prior to treatment with AQ200 causes damage to algae increasing permeability of AQ200 which subsequently inactivates aquatic plant cell walls.
- Benefits of using this combination include reduced application costs, reduced tendency of aquatic weeds to develop resistance and the ability to target a wider spectrum of aquatic weeds.

INTRODUCTION

Aquatic plants are a necessary component of water ecosystems. However, these plants are considered weeds when they are invasive and cause problems. Control measures must be used to prevent growth or reduce their abundance [1]**.** Nuisance aquatic weeds can be categorised into two groups. Algae, primitive plants that have no true stems, leaves or roots. Higher aquatic plants which include aquatic grasses, emergent plants, floating plants and submerged plants [1, 2].

IMPACTS OF AQUATIC WEEDS

Environmental	▪ Decrease water oxygenation, creating unfavourable conditions for aquatic organisms [3] ▪ Death of submerged aquatic organisms resulting in reduced biodiversity [3] ▪ Release of toxins secreted by some species of cyanobacteria and water quality degradation [4, 5]
Economic	▪ Difficulty in navigation and cargo transportation [4] ▪ Damages to tourism and fishing [4] ▪ Disruption of energy generation in hydroelectric power stations [4]
Social	▪ Alter water drinkability [4] ▪ Increase the price of water treatments [4] ▪ Cause problems in public supply and prevent recreational use [4]

USE OF AQ200 FOR AQUATIC WEED CONTROL

- The primary component of AQ200 is a contact herbicide widely used since the 1960s for the control of algae, floating, emergent and submerged aquatic weeds [6].
- It is rapidly absorbed by aquatic weeds and acts quickly on green tissue, typically within 5 minutes of application [7].
- Uptake of AQ200 through roots is negligible due to inactivation by soil or sediment particles [8].
- The active ingredient in AQ200 causes rapid inactivation of cells and cellular functions leading to the subsequent desiccation and necrosis of green parts of nuisance aquatic plants [9].
- Depending on environmental conditions, aquatic weed death occurs in 1 to 3 days [10].
- AQ200 has a short half-life (less than 48 hours) which is influenced by hydro-soil/sediment type; turbidity; pH; type of aquatic plants present; levels of microorganisms [8].
- AQ200 disappears quickly from water therefore it must be absorbed rapidly in order to be effective[8].

USE OF COPTROL FOR AQUATIC WEED CONTROL

- The active ingredients in Coptrol are copper complexes (copper chelates)
- Copper chelates have been used for algae control from as the early 1900s, when it was first discovered to have algaecidal properties [11].
- The copper compounds in Coptrol work by interfering with enzyme production. They inhibit cell division and photosynthesis [12].
- Warm temperature and sunlight stimulate Coptrol uptake by plants thereby increasing effectiveness as an algaecide [13]
- Results from treatments for algae occur within hours of application [8].

	AQ200	COPTROL
Timing of application	Throughout the entire growing season; Control of early growth is recommended. One application per growing season anticipated [14]	Ideally, apply on a sunny day when the water temperature is above 16^{0}C [14]
Max. water concentration	Do not exceed 2 mg/L [14]	Concentration should not exceed 10 mg/L
Waiting period	Plants absorb AQ200 rapidly; plant decline is usually within less than 7 days post treatment [14]	Effect can be observed in 3 to 10 days after treatment [14]
Use restrictions/ Precautions	Do not use herbicide in muddy water or on vegetation coated with mud or algae [14]	Water hardness must be considered prior to treatments. Should not be used where pH of water is below 6; leads to copper ion formation [14]

USE OF COPTROL WITH AQ200 FOR AQUATIC WEED CONTROL

- Coptrol and AQ200's active ingredient combination has been used for decades to improve aquatic weed control [8]
- Increased efficacy of combinations for aquatic weed (e.g. hydrilla, coontail, bladderwort) and algae control is the primary reason to mix different compounds [2]
- The active ingredient in AQ200 together with four other copper complexes is registered by the United States Environmental Protection Agency for use in several water bodies [15]

BENEFITS OF USING COPTROL WITH AQ200

- ✓ A wider spectrum of aquatic weed species can be controlled due to different modes of action [16]
- ✓ Reduced tendency of aquatic weeds to develop resistance [17]
- ✓ Lower application costs [16]
- ✓ Combinations reduce the phytotoxicity (toxic effect to plants) to non-target organisms, thereby alleviating environmental concerns [19]

STUDIES SUPPORTING THE USE OF COPTROL AND AQ200 COMBINATIONS

Several studies showed that the use of this combination resulted in an increased uptake of the active ingredient in AQ200 by submerged aquatic plants, when both products were above certain concentrations[12]

- One of the most common examples of increased herbicide efficacy in aquatic systems is the use of this combination for hydrilla control.
- The active ingredient in AQ200 applied alone resulted in a 44% reduction in hydrilla dry weight compared to nontreated control plants.
- Whereas with the addition of the combination, the reduction of dry weight ranged from 64 to 96% [20].
- The response to Coptrol was found to be additive; when more Coptrol is used, the greater the toxicity of AQ200 to aquatic weeds [20]

HOW IT WORKS

- Coptrol causes a loss of integrity in the cell membranes and results in increased permeability of AQ200 [12]
- The AQ200 then inactivates cells and their function through the release of strong oxidants [14]
- Coptrol also interferes with numerous other processes. It reduces the chlorophyll content and competed with iron uptake [21].

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