AQ200 AS AN AQUATIC HERBICIDE TO TREAT SUBMERGED AQUATIC WEEDS

Literature Review

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OVERVIEW

- This literature review explores the use of AQ200, a broad-spectrum aquatic dilution herbicide, as a method of treating submerged aquatic weeds in dams, lakes, ponds, etc.
- The application of AQ200 is easy as it can be either sprayed or tipped directly into water.
- AQ200 acts by preventing aquatic weed cells from carrying out photosynthesis, causing them to shrivel and die.
- AQ200 is safe to use in drinking water as it disappears within 1–10 days after treatment.
- AQ200 is ideal for use in irrigation, livestock watering and drinking water as its active ingredient meets the WHO guidelines for water safety.
- AQ200 has a low ecological risk as it does not bioaccumulate, and has a negligible risk on non-target aquatic organisms such as fish, birds, invertebrates and amphibians.

INTRODUCTION

While aquatic plants are a fundamental element of any aquatic ecosystem, their unchecked growth can have many negative impacts on waterbodies. The eutrophication of waterbodies by human impacts has led to an increase in aquatic weed growth rates. Particular aquatic weed species are also more capable at competing for natural resources than others, which is why a handful of species are responsible for most aquatic weed infestations. Aquatic weeds have negative effects on aquatic wildlife and reduce the overall health of the waterbody. They also limit uses of the waterbody by reducing access to drinking water, interfering with pumps for irrigation, interfering with fishing equipment, etc. Therefore, the need to control aquatic weeds safely and effectively is of utmost importance.

IMPACTS OF SUBMERGED AQUATIC WEEDS

Environmental	▪ Out-competes with native aquatic plants for resources such as sunlight and nutrients[1] ▪ Creates unfavourable conditions for aquatic organisms[2] ▪ Reduces the overall health and biodiversity of the waterbody[2,3]
Economic	▪ Aquatic weed debris block irrigation channels (intakes, pipes & pumps) increasing pumping time and cost[4] ▪ Blocks commercial fishing nets resulting in reduced fish production[4] ▪ Pollutes water used for livestock watering and irrigation[2–4] ▪ Prevents recreational activities like swimming, fishing, boating[4]
Social	▪ Contaminates and taints drinking water supplies[2,3] ▪ Reduces the aesthetic appearance of waterbodies[5] ▪ Causes pungent odours[5] ▪ Presents an ideal breeding site for disease carriers like mosquitos and snails[5]

WHAT IS AQ200?

- AQ200 is a broad-spectrum dilution aquatic herbicide that is used to control nuisance submerged aquatic weeds in ponds, lakes, dams, canals, and drainage ditches.[6–9]
- AQ200 is specially designed for use in aquatic environments unlike other commercial herbicides. Its unique formulation ensures that maximum efficacy when killing submerged aquatic weeds is maintained while having low ecological impacts.[10]
- The active ingredient of AQ200 was first registered for use in aquatic herbicides in 1961, and has consistently been used for aquatic weed control in commercial and residential settings.[10–12]
- Generally, using aquatic herbicides such as AQ200 rather than the physical removal of aquatic weeds is often both less expensive and a more thorough management strategy.[7,8]
- When targeting submerged aquatic weeds AQ200 is mixed 1:10 with town/tank water and added directly into water via spraying or injecting, after which it disperses within the water column.
- AQ200 has a 10–day withholding period where the water is not used, after which the treated water is safe to use for drinking, livestock watering, irrigation and recreation.

HOW IT WORKS

- AQ200 enters the green plant cells of aquatic weeds and prevents them from carrying out photosynthesis, essentially starving them of energy.[12,13]
- Without energy, vital cellular functions of the aquatic weed cells are impaired, resulting in them shrivelling and dying.[12]
- By using AQ200, the death of aquatic weeds can be achieved in up to 3–14 days.[14]
- AQ200 that doesn't enter the plant cells neutralises when it reaches the soil layer, thus clearing the water of any remaining AQ200.[10] This ensures that AQ200 doesn't accumulate in the environment.[15,16]

BENEFITS OF AQ200 OVER OTHER HERBICIDES

- AQ200 is specially formulated to target submerged aquatic weeds, whereas other common herbicides like glyphosate-based herbicides are not approved for application in aquatic environments.[17]
- Applying AQ200 directly to the waterbody prevents any AQ200 from reaching terrestrial plants on banks. In addition, AQ200 does not act on the roots of plants[12] meaning that terrestrial plants are safe from the action of AQ200 in the water. Other herbicides target the entire plant structure and affect both aquatic weeds and terrestrial plants alike.[17,18]

- Weed resistance to certain herbicides is significantly increasing due to the build-up of common terrestrial herbicides like glyphosate across various environments, including aquatic environments.[19,20] This means that aquatic weeds require larger dosages of these herbicides in order to be killed. AQ200 is intended for use only in aquatic environments, and due to the overall low AQ200 levels reported across other environments, aquatic weed resistance to AQ200 is not likely to occur.[21]
- Studies suggest that the active ingredient of AQ200 poses negligible effects on non-target aquatic organisms like fish, birds, invertebrates and amphibians,[22,23] whereas the active ingredients of other herbicides like glyphosate are classified as slightly to moderately toxic to aquatic organisms.[24]
- Overall, AQ200 is more effective than other herbicides at treating a variety of submerged aquatic weeds (Table 1).

Table 1: Comparison of the treatment efficacy of AQ200 and glyphosate-based herbicides.[25]

Aquatic group and vegetation	AQ200	Glyphosate	Coptrol
Algae			
planktonic	Poor	Poor	Excellent
filamentous	Good	Poor	Excellent
Chara/Nitella	Poor	Poor	Excellent
Submerged aquatic plants			
coontail	Excellent	Poor	No effect
elodea	Excellent	Poor	No effect
fanwort	Good	Poor	No effect
naiads	Excellent	Poor	No effect
parrotfeather	Excellent	Fair	No effect
pondweeds	Good	Poor	No effect

ECOLOGICAL SAFETY OF AQ200

- Low ecological risk of AQ200 due to it having a very short exposure time,[21] and due to strong binding with soil making it unavailable for plant uptake.[10] This makes it less likely for AQ200 to bioconcentrate and bioaccumulate in treatment sites.[15,16]
- The fate of AQ200 in aquatic systems is rapid, with AQ200 having no presence in treated water after 168 hours.[6,9]
- When using AQ200 as indicated, water treated with AQ200 is safe to use for irrigation of commercial and ornamental plants after 10 days of treatment, with visible results in up to 3–14 days.[26,27]
- Residual concentrations of AQ200 in treated water after 96 hours is far below the WHO guideline value for the active ingredient of AQ200 in potable water, meaning the treated water is completely safe to use as drinking water intended for both humans and livestock.[28,29]
- In compliance with Australian Government regulations, the label registration of AQ200 states a prudent withholding period of 10 days after treatment.

FAVOURABLE CONDITIONS FOR AQ200

- Highly turbid water requires the use of a flocculant before treatment with AQ200 as one of the most common causes of treatment failure is the deactivation of AQ200 by suspended clay or organic particles in water.[30,31]
- Similarly, mud or algal deposits on the surfaces of aquatic plants also act as barriers to AQ200, thus reducing its efficacy (Figure 1). The use of Coptrol in addition to AQ200 treatment will ensure that the effect of algae on the efficacy of AQ200 will be minimal.
- Scientific studies have shown that Coptrol makes submerged aquatic weeds more susceptible to AQ200[33], thus improving the overall effectiveness of AQ200 (Table 1). It does this by weakening the cell walls of submerged weeds[33], which leads to increased AQ200 action. A combination treatment dosage of Coptrol-AQ200 caused a 20–52% improvement in efficacy when treating Hydrilla compared to the same treatment dosage of solely AQ200.[34] When more Coptrol is used, the greater the efficacy of AQ200 in treating submerged aquatic weeds.[34]
- It is best to treat most aquatic vegetation early in the growing season when the plant is rapidly growing.[26]

Figure 1: Dirtiness scale for the efficacy of AQ200 when treating submerged aquatic weeds.[32]

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