

SODIUM VS POTASSIUM USAGE IN DAM SEALER PRODUCTS

Literature Review

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Prepared for Aquatic Technologies

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OVERVIEW

- This literature review explores the differences between using sodium-based Dam Sealer products vs potassium-based Dam Sealer products.
- Potassium-based Dam Sealer products may have unwanted implications.
- Studies exploring the health impacts of potassium-based Dam Sealers have found that excess potassium in waterbodies could result in potentially undesirable outcomes.
- Studies exploring the efficacy of sodium-based Dam Sealers have found that it creates the most effective and strongest seal against water leaks.
- Sodium-based minerals have seen extensive use across multiple industries since the early 1900s, attesting to its safety.
- Sodium-based Dam sealer is environmentally friendly and safe, making it ideal for use with water intended for crops and livestock.
- Dam Sealer products in Australia that are sodium-based, include Dam Stop Leak and Dam Stop Leak Professional, by Aquatic Technologies in Melbourne, Australia.

INTRODUCTION

Since the early 20th century sodium-based minerals have seen more individual uses than other minerals known, as they have a multitude of applications in various industries including the foundry industry, the food/agriculture pelletisation industry, and the well drilling industry [1]. Because of the large surface area, high water absorption and high swelling properties of sodium-based mineral molecules, the potential of these minerals as an excellent soil sealant has recently been realised by the water industry, making it ideal for use as a Dam and Pond sealer [2]

SODIUM-BASED DAM AND POND SEALERS

- The active constituent of Dam Stop Leak and Dam Stop Leak Professional is sodium.
- Upon contact with water, Dam Stop Leak and Dam Stop Leak Professional forms a superabsorbent polymeric network that is highly impermeable to water, making it an effective seal against leaks in Dams and Ponds [3]. This network is usually stronger at the molecular level than the polymeric network formed by other swelling clays [1]
- Sodium-based Dam sealer is environmentally friendly and safe to use in waterbodies as it does not accumulate easily [4,5]
- The active sodium-based constituent of Dam Stop Leak and Dam Stop Leak Professional is classified as safe for consumption, and is often used as a binding agent in animal feeds [6]. This makes it ideal for use in farm dams where water is commonly used for crops and livestock.
- Sodium-based Dam sealers have the capacity to absorb certain pesticides due to the cationic nature of their active constituent, thus improving water quality in dams that are located at or near farms [7,8]
- A high sodium-to-potassium ratio of water helps to suppress the growth of disease-carrying water fleas [9]

POTASSIUM-BASED DAM AND POND SEALERS

- The active constituent of potassium-based Dam sealers are potassium-based minerals that can lead to higher potassium concentrations in water.
- High potassium levels in water stimulate the growth and birth rates of water fleas [10]
- These water fleas are often carriers of harmful bacteria and spores of virulent fungi like *Metschnikowia bicuspidate* [10]
- High potassium levels in water stimulate the growth of unwanted green algae strains such as *Coelastrella oocystiformis* and *Chlorolobion braunii* [11] and toxic cyanobacteria strains like *Microcystis aeruginosa* [12]

HOW IT WORKS

- Porosity of soil is highly variable, which can be exacerbated during long periods of high heat and low rainfall, leaving the surfaces of Dams exposed to sunlight. These conditions cause cracks to form in the Dam bases that leak large amounts of water.
- Sodium-based Dam Stop Leak and Dam Stop Leak Professional are ideally applied to Dams that already contain water. The hydraulic action of leaking water is necessary for the Dam sealer to enter cracks and pores in the Dams' surfaces.
- Upon application to water, the individual Dam Stop Leak molecules swell up to multiple hundred times their weight and form a hydrogel comprised of complex crosslinked networks of polyelectrolytes [13,14]
- The fluid pressure of the water causes the resulting sodium-based hydrogel to expand more and to bind stronger to the surrounding soil particles, thus forming a highly effective impermeable seal against water leaks [1,2]
- Potassium-based Dam sealers are less effective than Sodium-based Dam sealers when added to water as the resulting potassium-based hydrogel matrix is comprised of far more rigid physical crosslinks, rendering the network difficult to stretch and reducing the free volume available, thus decreasing the water retention ability of the hydrogel and consequently affecting the quality of the hydraulic seal [15]

HEALTH AND ENVIRONMENTAL IMPLICATIONS OF SODIUM VS POTASSIUM USAGE IN DAM AND POND SEALER

Table 1. Comparison of health and environmental implications of sodium-based Dam sealers and potassium-based Dam sealers.

Potassium-based Dam and Pond Sealer	Sodium-based Dam and Pond Sealer
<ul style="list-style-type: none"> • Stimulates the growth and reproduction rates of water fleas, which are often carriers of harmful bacteria and highly virulent funguses like <i>Metschnikowia bicuspidate</i> [9] • Stimulates the growth of unwanted green algae strains such as <i>Coelastrella oocystiformis</i> and <i>Chlorolobion braunii</i> [12] • Allows harmful cyanobacteria like <i>Microcystis aeruginosa</i> to thrive [13] 	<ul style="list-style-type: none"> • Improves water quality by absorbing certain minerals dissolved in water [6] • Has little effect on algal growth rates [4] • Active constituent is used extensively in the feed production industry, making it safe for application in water used by livestock [1]

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