RECLAMATION
Managing Water in the West

U.S. Department of the Interior
Bureau of Reclamation

Viral Treatment of Harmful Algal Blooms

The use of cyanophages as a biological control for harmful cyanobacterial blooms in freshwater reservoirs

Research Bulletin
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Viral vectors that infect algae causing harmful algal blooms in freshwater reservoirs were investigated, and the current state of knowledge on the subject is presented.

Mission Issue

Reclamation manages numerous reservoirs across the West. Harmful algal blooms are increasingly prevalent, and a phage-based biocontrol approach shows promise. Further research is needed to investigate this novel approach.

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Problem

Harmful Algal Blooms (HABs) are becoming increasingly more prevalent and more severe. In freshwater reservoirs these cyanobacterial blooms can reduce the dissolved oxygen in the water suffocating fish and aquatic wildlife. Some HAB causing species produce toxins which are harmful to humans and animals. There is currently no proven, effective method to prevent or arrest these blooms.

Solution

The solution to this problem has not been found. This is a review of the currently available knowledge on cyanophages (a type of virus that infects cyanobacteria), their interactions with their host species of cyanobacteria, and a short case study on what it would take to dose a reservoir with cyanophages. It is intended to provide a primer on this viral biocontrol technology. This informational report will provide basic technical information to enable those interested in novel solutions to HABs to better understand the cyanophage control approach.

Phages attacking a bacterium.

"Biocontrol approaches to techno-ecological problems enable us to use the solutions nature has already developed. The viral agents that would be added to the water are already present; the key to this technology will be which ones to add and how many."

Chris Waechter
Civil Engineer
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More Information

https://www.usbr.gov/research/projects/detail.cfm?id=19157

Application and Results

The successful development of this technology would be applicable for any reservoir experiencing HABs. This technology has the potential to stop HABs without requiring extensive amounts of chemicals or large outlays of energy. The attractiveness of this technology lies in the fact that nothing is being added to the water that is not already present.

Future Plans

This basic overview of cyanophages and their effect on cyanobacteria will be used to inform future experiments. It is recommended that further research projects focus on creating procedures for isolating, culturing, and storing cyanophages. This would create a methodology for identifying and creating a culture for a cyanophage that infects whatever cyanobacteria is causing the HAB being investigated. With the introduction of a robust method for identifying strains and creating cultures of cyanophages that infect a HAB causing cyanobacteria, it will allow individual reservoir management entities to do their own investigations and will make it easier for academic institutions to identify and catalog more cyanophages. The more strains of cyanophage that are identified, the more opportunities there will be to improve this technology.