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Strategies and solutions for reversing eutrophication in aquatic ecosystems

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Abstract

Eutrophication is a significant environmental issue that occurs mostly in water bodies such as lakes, ponds and rivers. It has adverse effects on the environment, marine life and human health. This brief research paper explores the issue of eutrophication, including its harm and effects, along with methods and innovations to tackle and reverse eutrophication.

Keywords: Eutrophication, total phosphorus, orthophosphate, ascorbic acid method, total nitrogen

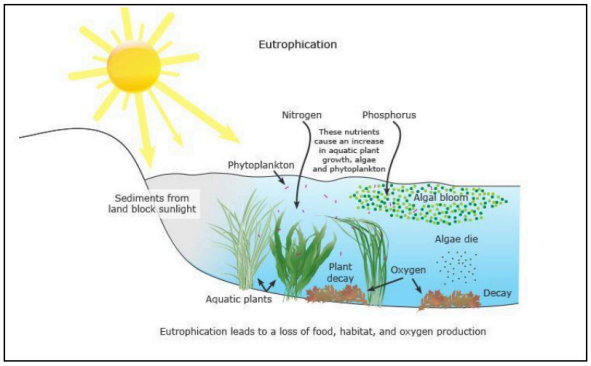
Introduction

Eutrophication is a process in which a water body becomes overly enriched with nutrients which results in excess growth of simple plant life. Plants and organisms such as algae and planktons are the ones that grow and sustain. Eutrophication is a severe environmental issue as it completely brings down the oxygen levels and deteriorates the quality of water. Eutrophication of water bodies eventually makes them completely dead and unable to sustain any sort of marine animal life. It completely destroys the ability of the water body to sustain stability in the ecosystem (BYJU'S, 2023).

Research question

What are the main nutrients responsible for eutrophication, and what strategies can be implemented to tackle the problem and restore the affected body?

Figure 1
Eutrophication process



Note: Source: The University of Waikato Te Whare Wānanga o Waikato, 2013.

Figure 2
Thick algae buildup on a lake

Note: Source: Energy Education, n.d.

Methodology

The paper presents qualitative findings where the eutrophication causes, effects and counter measures have been analyzed through literature review. This involved a review of peer-reviewed articles, books and other environmental publications related to water bodies and pollution. For instance, assent research articles were retrieved from valid academic search engines such as PubMed, Google Scholar, and JSTOR while usable reports were obtained from trustworthy agencies such as Environmental Protection Agency and United Nations Environmental Programme. Articles were qualitative content analyzed as units of analysis paying attention to aspects of nutrient pollution, occurrence of algal blooms and subsequent ecological impacts.

Discussion

Eutrophication is caused mainly due to two main nutrients: Phosphorus and Nitrogen. Water bodies become eutrophic and contain excess nutrients due to multiple reasons such as manure and fertilizers from agriculture being washed into them during heavy rains, or sewage or industrial waste products.

Phosphorus is the major cause for extreme algae and plant growth. Excess of it only leads to reduction of water quality and oxygen concentration which completely kills any other form of life to sustain in it. Total phosphorus (TP) is the measure of all of the phosphorus present in the water body, be it in its dissolved or particulate form (Tuser, 2022). Phosphate levels around and above 0.08 ppm phosphate trigger simple plant blooms. TP should be 'digested' to be converted into orthophosphate.

Orthophosphate is the most common and basic form of phosphorus in water which can be measured using the ascorbic acid method. Phosphorus management can be done using aluminium salts which inactivates phosphorus in the water and alters nutrient load and effects in ponds or lakes (EPA, n.d.).

Nitrogen in water is in the form of nitrates that provoke more algal growth than the ecosystem can handle. Total nitrogen is the sum of all the nitrogen compound forms present together in the waterbody. The Kjeldahl method will find nitrogen in water (BYJU'S, 2022). Nitrogen in water can only be tried to be prevented but cannot be completely removed from eutrophic bodies (at least this is the case with the current research and technologies). (N.C. State Extension, n.d.)

With proper management of municipal discharge, sewage treatment, and controlled agricultural fertilizer usage, eutrophication can be prevented but not completely stopped with the technology that we have currently.

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